THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXVII. No. 1932.] LONDON, MAY 7, 1901. [53RD YEAR. PRICE 6d.

TROTTER, HAINES, & CORBETT, LIMITED,
Brettell's Estate
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Special Lumps, Tiles, and Bricks for Regenerative and Furnace Work.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

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HEBBURN MAIN GAS COALS.

Yield of Gas per Ton . . 10,500 Cubic Feet.
Illuminating Power . . . 16·4 Candles.
Coke . . . . . 68 per Cent.

For Prices, f.o.b. Ship or Delivered by Rail, apply to
The Wallsend & Hebburn Coal Company, Ltd.
8 Lombard Street,
NEWCASTLE-ON-TYNE.
W. RICHARDSON, Fitter.

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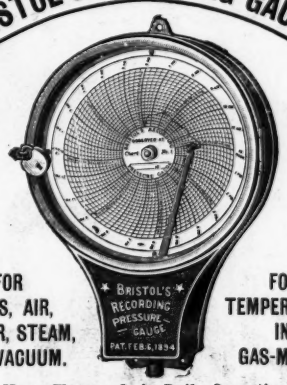

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FOR TEMPERATURE IN GAS-MAINS.
Many Thousands in Daily Operation.

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23, COLLEGE HILL,
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— ESTABLISHED 1830. —
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Manufacturers & Contractors.
THE ONLY MAKERS OF
PATENT ANTIMONY PAINT.
Parker's Imperial Black Varnish,
Oxide Paints, Oils, and General Stores, for Gas and Water Works.
WORKS:
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CANNEL COAL MERCHANT,
97, WELLINGTON STREET, GLASGOW.
Prices and Analysis of all the Scotch Cannels on Application.

Wrought-Iron

And Fittings and Accessories.

LAMBERT BROS., WALSALL,
MANUFACTURERS OF
WROUGHT-IRON TUBES & FITTINGS for GAS, WATER, & STEAM.
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Enquiries . .
for . . . . .

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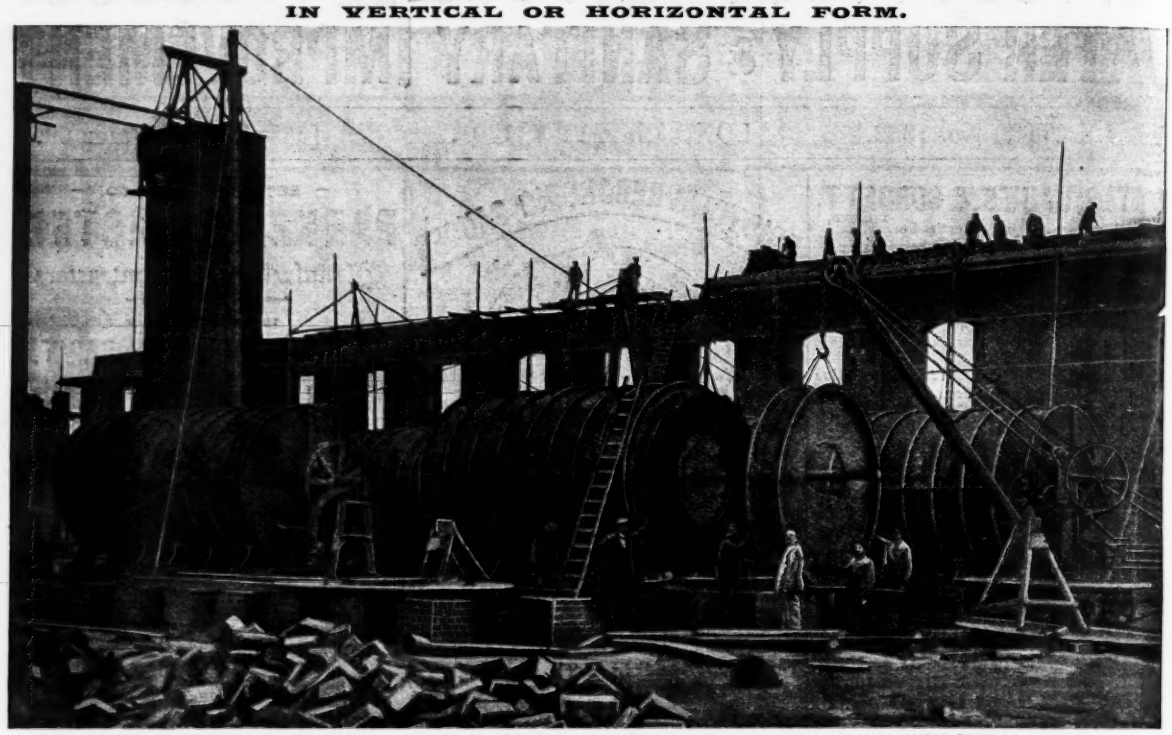
PIPES IN STOCK
THIS WEEK
FOR IMMEDIATE DESPATCH AS FOLLOWS:—

3 in.	diameter	. . .	200 Tons.
4 in.	,,	. . .	100 ,,
5 in.	,,	. . .	70 ,,
6 in.	,,	. . .	250 ,,
7 in.	,,	. . .	20 ,,
8 in.	,,	. . .	200 ,,
9 in.	,,	. . .	10 ,,
10 in.	,,	. . .	25 ,,
12 in.	,,	. . .	50 ,,

PATENT "NEW" SCRUBBER-WASHER

IN VERTICAL OR HORIZONTAL FORM.



VIEW SHOWING BATTERY OF SIX MACHINES IN COURSE OF ERECTION, EACH MACHINE TO DEAL WITH 3,000,000 CUBIC FEET OF GAS PER DIEM.

WE ARE NOW CONSTRUCTING FOUR OF THE LARGEST MACHINES IN THE WORLD FOR THE EXTRACTION OF AMMONIA AND CYANIDE.

RESULTS GUARANTEED.

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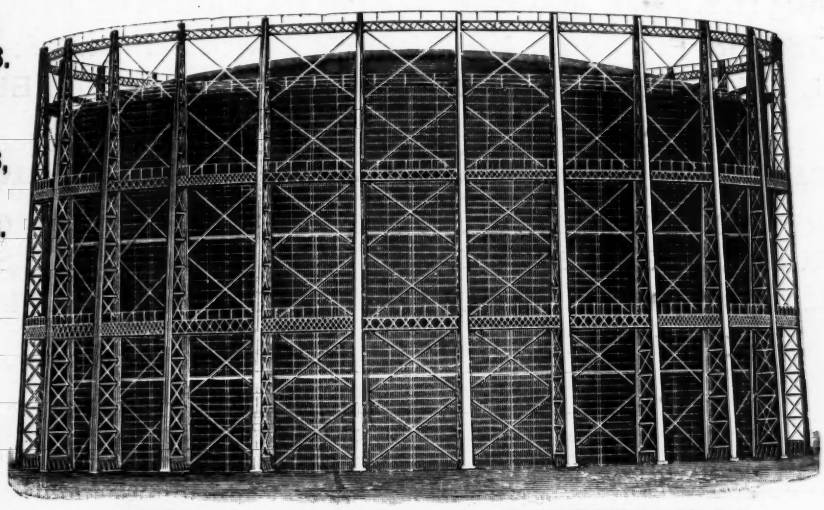
OIL PLANT AND CHEMICAL APPARATUS.

BRIDGES, GIRDERS, WHARVES, PIERS.

ROOFING OF EVERY STYLE.

PIPES, VALVES, AND CONNECTIONS.



GAS APPARATUS OF EVERY DESCRIPTION.

RETORTS, CONDENSERS, SCRUBBERS, PURIFIERS.

GASHOLDERS AND TANKS.

ENGINES, EXHAUSTERS, STEAM BOILERS AND FITTINGS.

THREE-LIFT GASHOLDER. Capacity, SIX MILLION cubic feet.
240 feet Diameter by 45 feet Deep each Lift. Erected at Glasgow, 1893.

London Office: 6, LITTLE BUSH LANE, CANNON STREET.

THE "CLIMAX"

Patent Incandescent Light Intensifier.

40 PER CENT. INCREASE OF LIGHT.

Can be fitted to any ordinary Incandescent Burner.

No. 4239.—For use with an ordinary 6-in. Chimney.

ADVANTAGES.

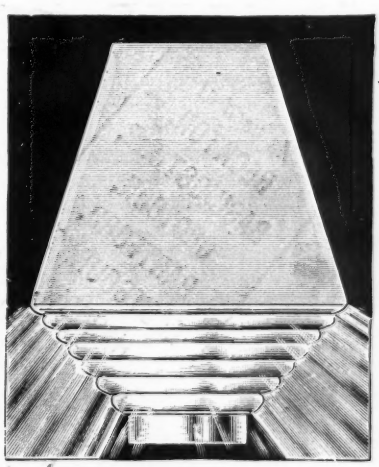
Increased Light.

Longer Life of Mantles.

Greater Durability of Chimneys.

An Ordinary Incandescent Globe can be used, no Special Globe being required.

Catalogue sent on application.



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Dioptric Opal and Flint Squat for Incandescent Burner. Increased Reflecting Power.

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21 & 23, FARRINGDON ROAD, LONDON, E.C.

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PLANT, APPARATUS, and MACHINERY for GAS and CHEMICAL WORKS.

RETORTS and FITTINGS, MOUTHPIECES with Self-Sealing Lids.

Improved COAL and COKE HANDLING PLANT, CONVEYORS, and ELEVATORS,

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PURIFIERS with Planed Joints a Speciality.

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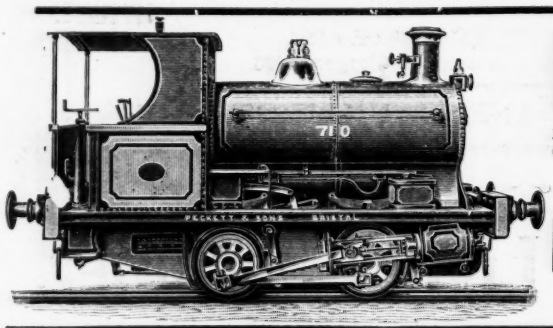
GASHOLDERS, Cast-Iron or Steel Tanks.

DESIGNS, SPECIFICATIONS, and ESTIMATES FREE.

PIG IRON (Special Quality) for Engine Cylinders. GAS COAL famous for its UNRIVALLED EXCELLENCE.



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LOCOMOTIVES of all Sizes and Gauges specially constructed for Main and Branch Lines, Contractors, Docks, Gas-Works, Collieries, Iron-Works, Brick and Cement Works, &c. Locomotives of various Sizes always in Stock, ready for Immediate Delivery.

Photographs, Specifications, and Prices on Application.

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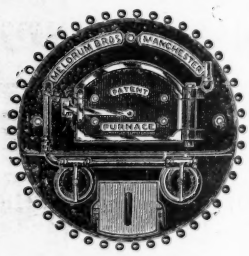
BREEZE

FURNACE.

As used at BECKTON, BASINGSTOKE, CROYDON, DARTFORD, EASTBOURNE, HARROW, MAIDENHEAD, N. MIDDLESEX, RAMSGATE, SOUTH METROPOLITAN, WEST HAM, WATFORD, &c., &c.

Specially suitable for GAS-WORKS.

OVER 9500 IN USE.



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"NEW CENTURY" PATTERN

PATENT COIN PREPAYMENT GAS-METERS

FITTED WITH DETACHABLE ATTACHMENTS.
ARRANGED FOR 1d., 1s., OR ANY OTHER COIN DESIRED.

A large number of these Meters have been sent out this Year, which are giving every satisfaction.

Dry Meter in Tin-Plate Case, fitted with Attachment.

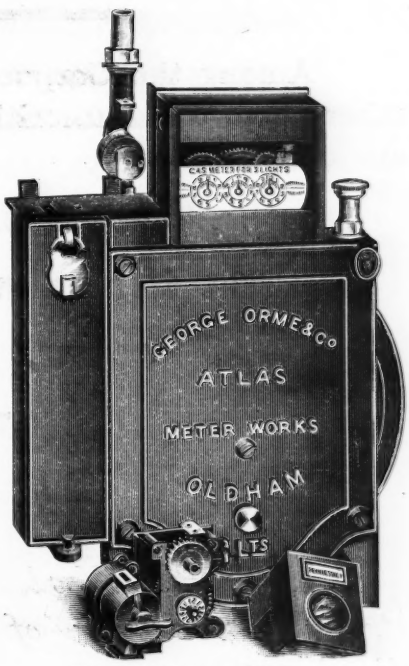
Price changed *in situ* by means of one Crown Wheel only.

COMPACT.

DURABLE.

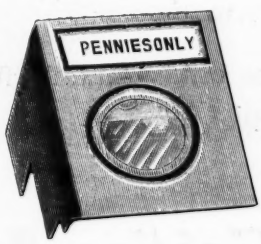
RELIABLE.

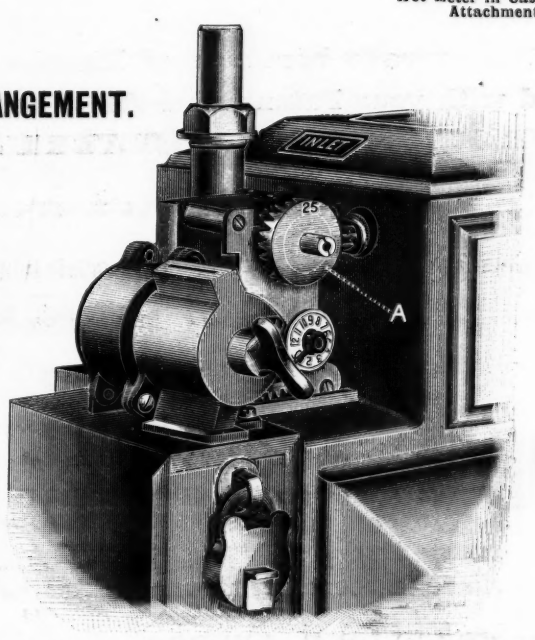
SIMPLE.



Wet Meter in Cast-Iron Case, with Attachment Removed.

VIEW OF PRICE-CHANGING ARRANGEMENT.





CHANGE OF PRICE EFFECTED BY SIMPLY REMOVING CROWN WHEEL "A" AND REPLACING SAME WITH ANOTHER WHEEL.

ANY FURTHER PARTICULARS WILL BE SUPPLIED UPON APPLICATION.

INCANDESCENT GAS LIGHTING A SUCCESS

BY USING THE

"AVIL" SYSTEM.

THE ONLY SUCCESSFUL ANTI-VIBRATOR ON THE MARKET, AND WHICH HAS STOOD THE TEST OF SEVEN YEARS' PRACTICAL USE.

Among the Corporations, Gas Companies, Railway Companies, or other Lighting Authorities who have extensively adopted our Frames are the following:—

Bradford Corporation (12,000),
Glasgow Corporation,
Leeds Corporation,
Huddersfield Corporation,
Burnley Corporation,
Midland Railway Co. (10,000),
Great Northern Railway Co.,
Manchester Corporation,
Salford Corporation,
Aberdeen Corporation.

Mr. Chas. Wood, Gas Engineer of the Bradford Corporation, and President this year of the Manchester District Institution of Gas Engineers, says:—

"The average breakage of Mantles on the Incandescent Burners "fitted with your Patent Anti-Vibration Frames has been LESS THAN "FOUR PER ANNUM FOR SEVERAL YEARS PAST."

For full Particulars of your Frames, which are alike suitable for Street and Factory Lighting, apply to

THE

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Telegrams: "RESILIENT, LEEDS." Telephone 116.

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FOR ELEVATING AND CONVEYING

Supersedes all others for dealing Automatically with

HOT COKE.

THESE CONVEYORS ARE NOW AT WORK IN ENGLAND OR IN HAND AT THE FOLLOWING WORKS:—

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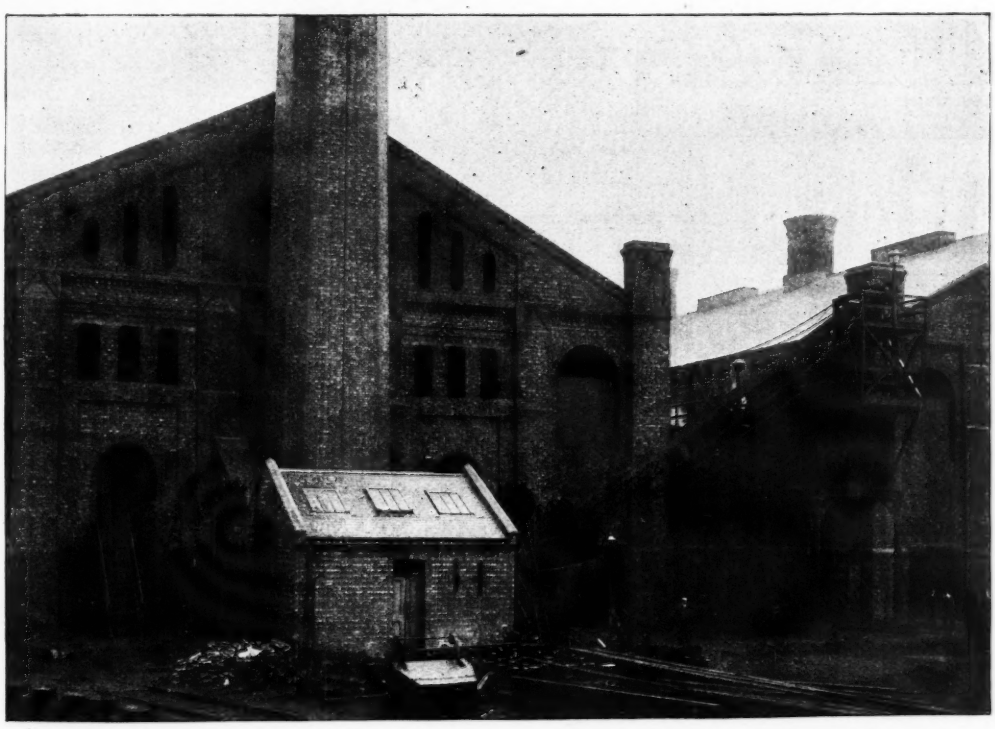
Halifax Corporation.
Wakefield Gas Co.
Walsall Corporation.
Bury Corporation, Lancs.
Derby Gas Co.
Bath Gaslight & Coke Co.



The De Brouwer Coke Conveying and Elevating Plant at the Newcastle and Gateshead Gas Company's Redheugh Works.

GUARANTEED BY SOLE MAKERS:

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Latest Improvements.

SULPHATE OF AMMONIA APPARATUS

SHOWING BEST RESULTS.

Economy in Working.

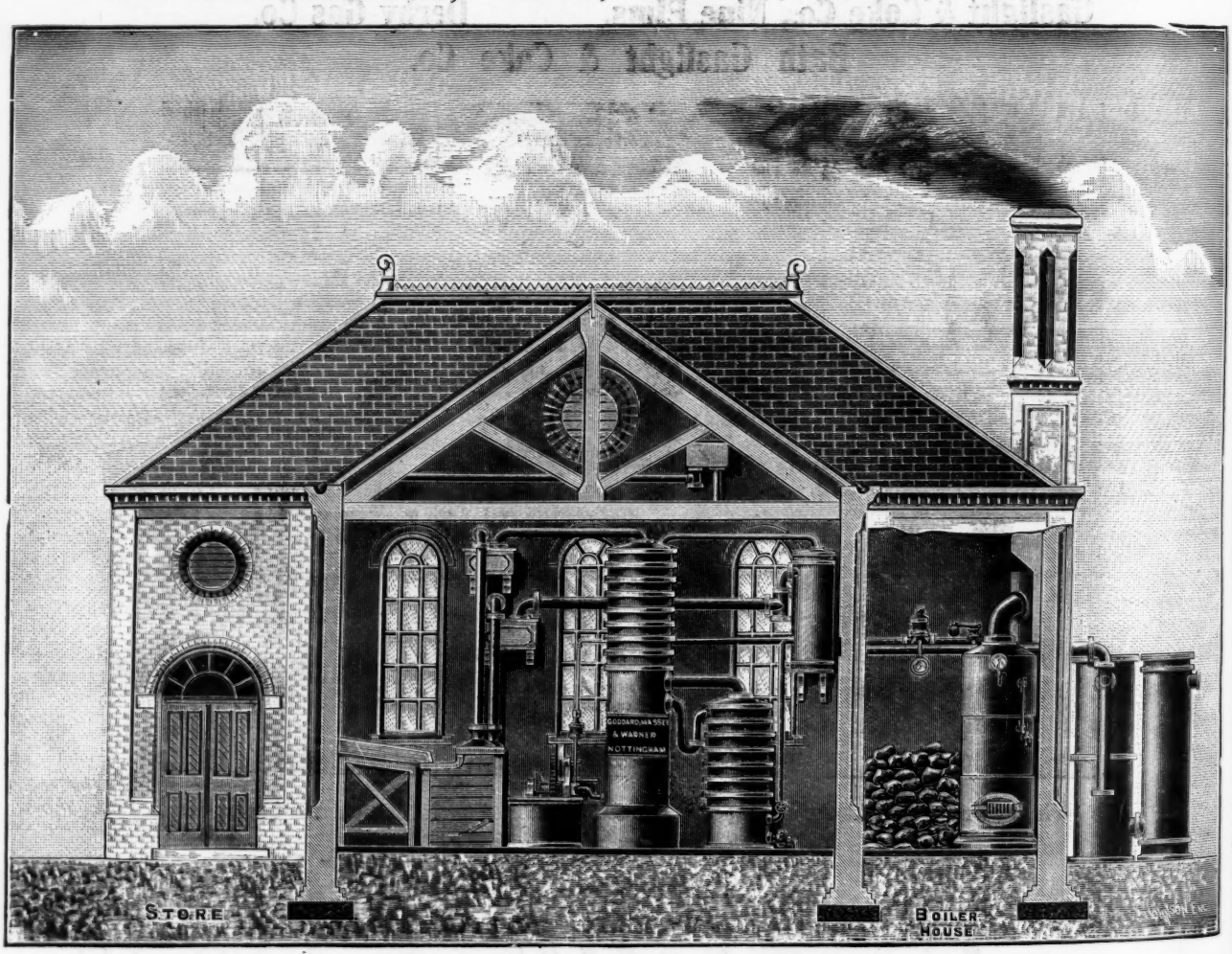
All Ammonia Recovered.

Small Quantity of Steam.

DURABLE. EFFICIENT. NO NUISANCE.

MAKERS OF ELLERY'S PATENT SATURATOR.

AIR COMPRESSORS, PUMPS, BOILERS, ROOFS, TANKS, &c.



GODDARD, MASSEY, & WARNER, LIMITED,

NOTTINGHAM.

ARROL-FOULIS

PATENT HYDRAULIC MACHINERY

FOR

CHARGING AND DRAWING GAS-RETORTS

SIR WILLIAM ARROL & CO., Ltd., Sole Makers,

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PLANS AND ESTIMATES FURNISHED ON APPLICATION.

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Vauxhall.
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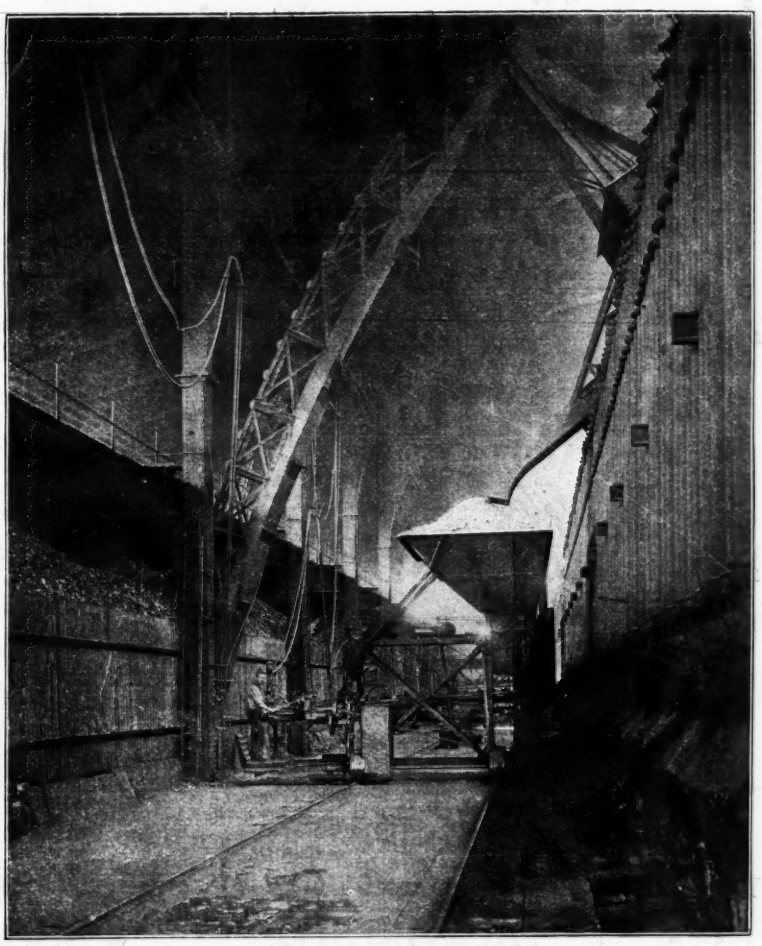
Wapping.
Poplar.

BROMLEY GAS-WORKS (KENT).

EDINBURGH GAS-WORKS.

LIVERPOOL GAS-WORKS.

BRIGHTON GAS-WORKS.



THE ARROL-FOULIS MACHINES Are Employed at the following Works—

LEEDS GAS-WORKS.

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BRITISH GAS CO.—
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BOLTON GAS-WORKS.

IMPERIAL CONTINENTAL GAS ASSOCIATION—
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Vienna.
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HAGUE CORPORATION GAS-WORKS—
Hague.

METROPOLITAN GAS-WORKS—
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CLEVELAND GAS-WORKS—
Cleveland, Ohio, &c., &c., &c.

NEARLY 300 MACHINES ARE AT WORK OR IN COURSE OF CONSTRUCTION.

BECKTON GAS-WORKS.

THE TIME TAKEN TO DRAW AND CHARGE EACH RETORT BY THESE MACHINES AVERAGES

UNDER ONE MINUTE.

ALDER & MACKAY

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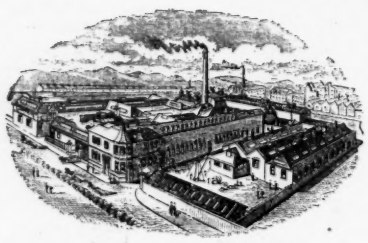
MANUFACTURERS OF GAS-METERS FOR ALL USES

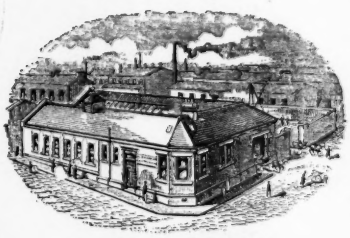
Special Features—

DRY METERS IN CAST-IRON CASES.

Established **1850.**



EDINBURGH.



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WET AND DRY PATENT PENNY-IN-THE-SLOT PREPAYMENT METERS.

New Grange Works, EDINBURGH.	Ventnor Street Works, BRADFORD.

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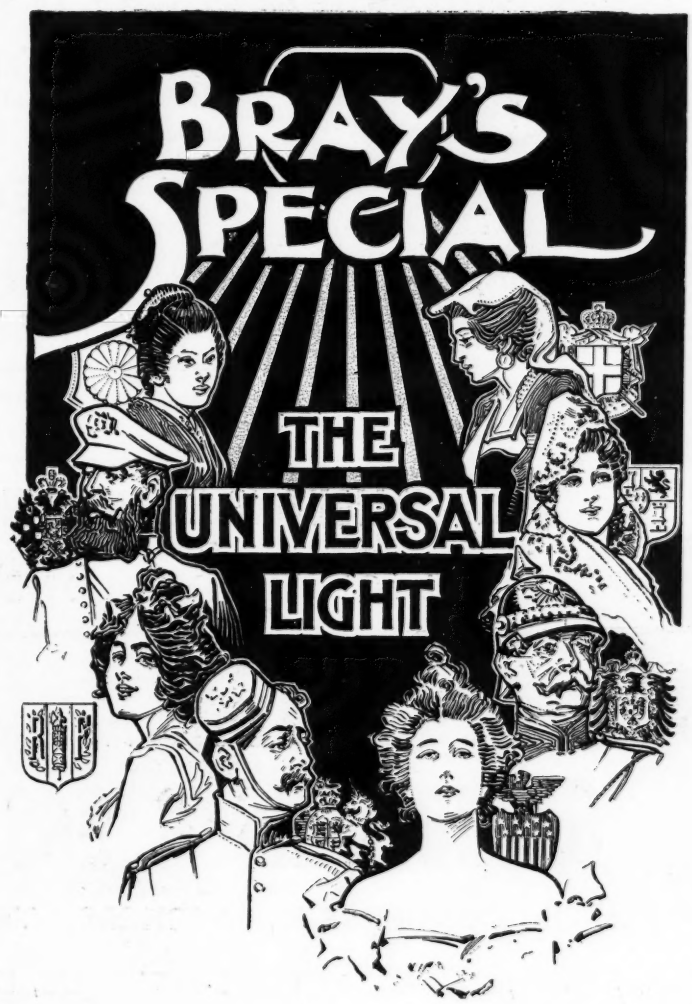
"SPECIAL" GAS-BURNERS

Union-Jets.



Slit-Unions.

Screwed
for Globe Holder.

Screwed
for Globe Holder.

ON SALE THROUGHOUT THE WORLD.

Send for our New Illustrated Blue Book and Price List.

GEO. BRAY & CO.,

GAS LIGHTING ENGINEERS,

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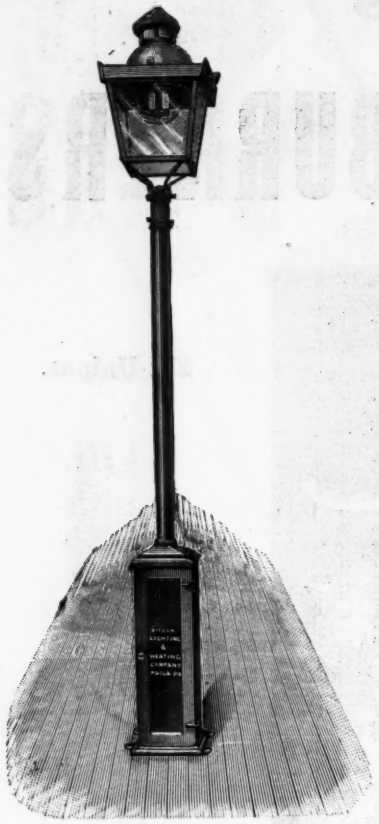

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"KITSON" OIL LIGHT

(VAPORIZED PETROLEUM BURNT WITHIN A MANTLE.)

1200-Candle Power, 1d. per Hour!!!

For Streets, Stations, Yards, Factories, &c., &c.

A System of Lighting surpassing all others in respect of

EFFICIENCY AND ECONOMY.

Self-contained Lamp-Posts.

No tearing up of the Thoroughfares.

See Professor Lewes and Dr. Boverton Redwood's Joint Report.

("JOURNAL," *Feb.* 5, *p.* 338.)

KITSON LIGHTING AND HEATING SYNDICATE, LIMITED,

BLACKFRIARS, LONDON, E.C.

THE HORSELEY CO., LTD., TIPTON, STAFFORDSHIRE.

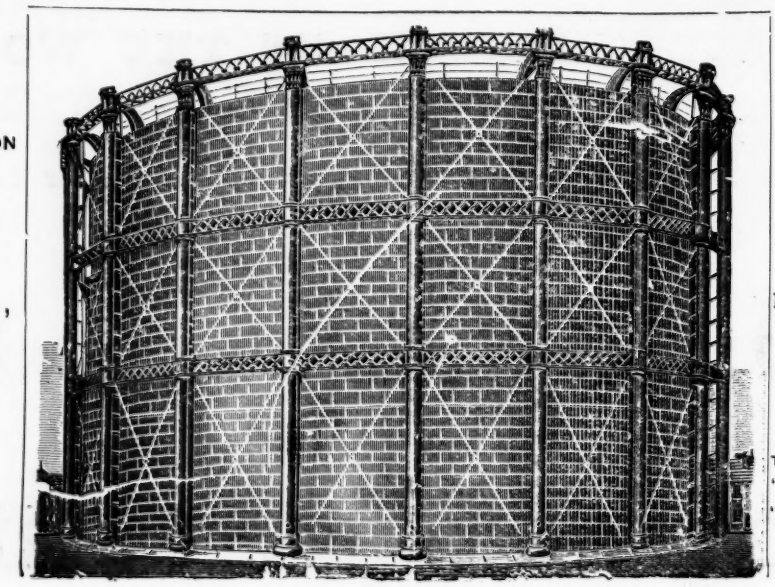
MAKERS OF

GASHOLDERS & GAS PLANT.

PURIFIERS, SCRUBBERS, CONDENSERS, WASHERS, TANKS, VALVES, PIPES, LAMP PILLARS, RETORT-FITTINGS, ETC.

ALSO ALL KINDS OF STRUCTURAL IRON AND STEEL WORK.

BRIDGES, ROOFS, PIERS, ETC.



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STAFFORDSHIRE.

LONDON OFFICE:
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WESTMINSTER.

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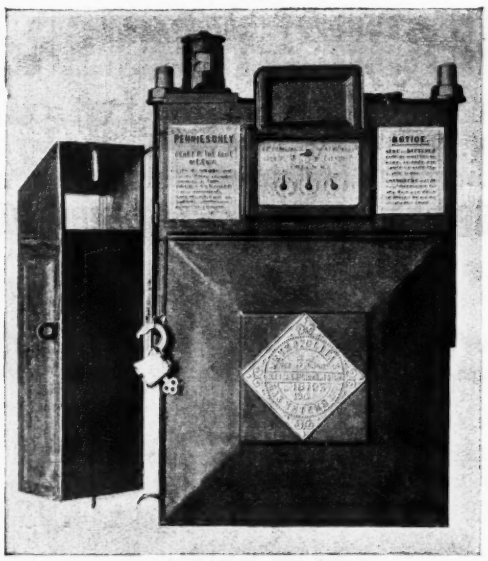
METROPOLITAN GAS METERS LIMITED,

MANUFACTURERS OF DRY ORDINARY & PREPAYMENT METERS.

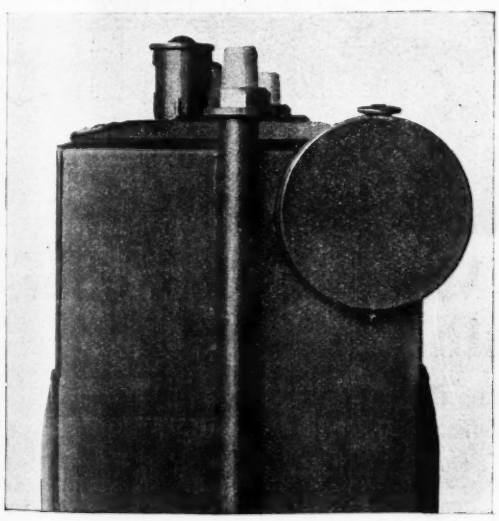
EXTRA LARGE. PATENTED.



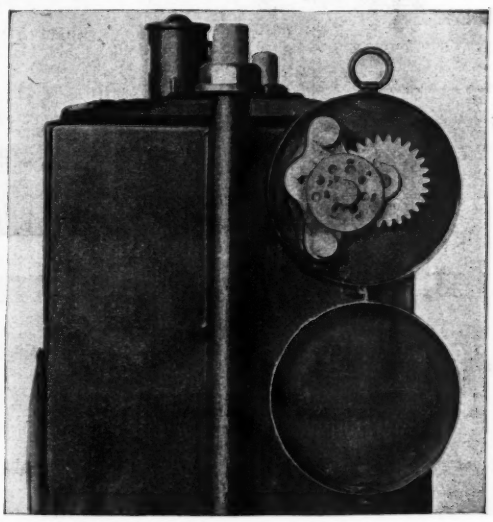
NOVEL & DETACHABLE MONEY-BOX.

PRICE CHANGER ON THE RIGHT OR OUTLET SIDE OF METER.

NO SCREW HEAD TO FIND UNDER WAX SEAL, MERELY LEVER UP SEAL RING.



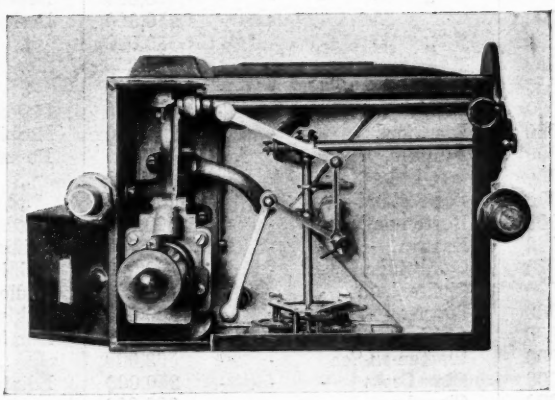
THE METER



POSITIVE CHANGE EFFECTED IN ONE MINUTE

ONE WHEEL TO BE REMOVED ONLY.

SIMPLICITY ITSELF.



ACCURATE. VERY STRONG.

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Telegraphic Address; "GASOMETER, LONDON." Telephone No. 1259 HOP.

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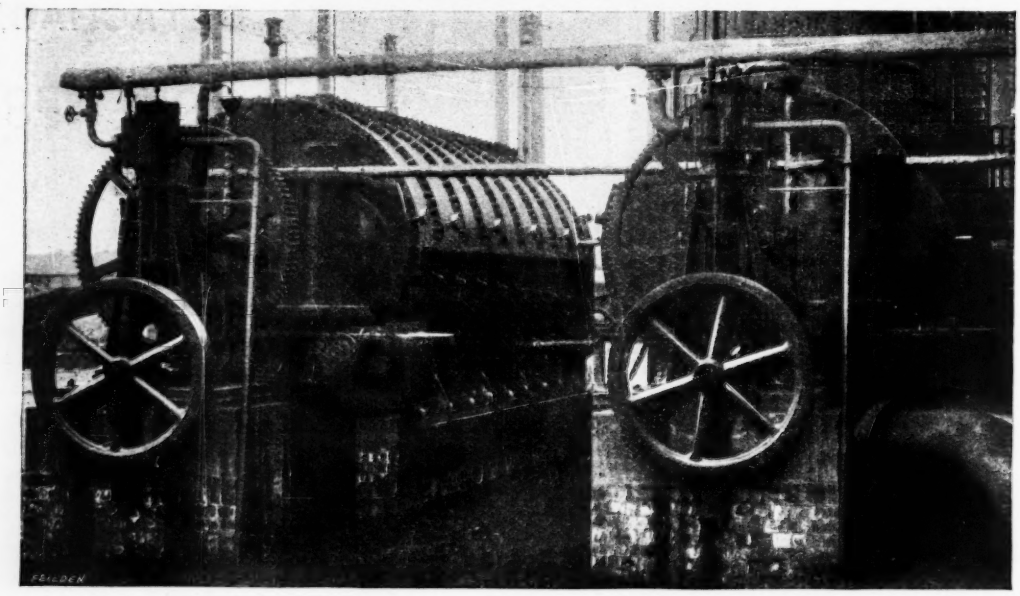
PATENT "STANDARD" WASHER-SCRUBBERS.

OVER **650** IN USE

And in Course of Construction.

MAXIMUM STRENGTH LIQUOR PRODUCED. MINIMUM WATER SUPPLY REQUIRED.



List of Patent "Standard" Washer-Scrubbers erected in Great Britain and Ireland.

(N.B.--Whole World List on Application).

	Capacity Cub. Ft. per 24 hours.
Aberystwyth	250,000
Accrington	750,000
Aldershot	200,000
,,	400,000
Altrincham	600,000
Animal Charcoal Co., London	200,000
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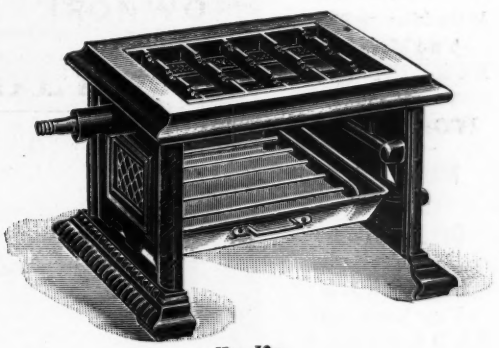

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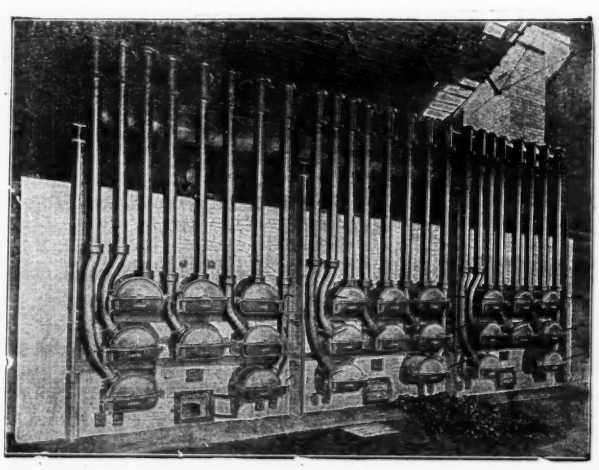

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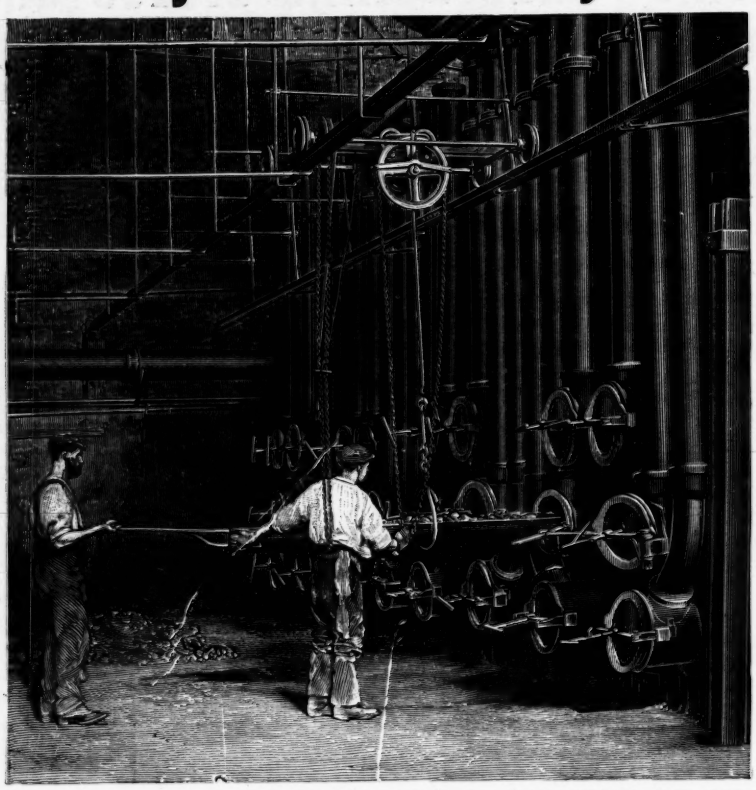

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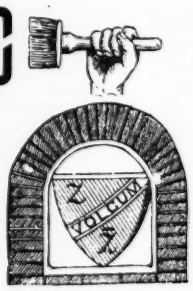

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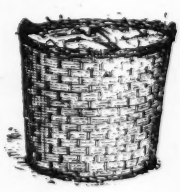

CONTENTS.

EDITORIAL NOTES.

GAS, LIGHTING, &c.—
The Meeting of the Institution of Gas Engineers 1181
Mond Gas and Electrolysis 1181
The Examination in Gas Manufacture . 1182
The Export Duty on Coal 1182
Parliament and Directors' Votes . . . 1183
The Prospects of a General Strike of Coal Miners 1183
Devonport Gas-Works Purchase . . . 1183
WATER AFFAIRS—
Additional Water Storage in the Thames Valley 1184

INSTITUTION OF GAS ENGINEERS.

GENERAL MEETING IN LONDON—
Review of Proceedings 1185
The Proceedings Summarized 1187
General Report 1193
Annual Report and Accounts; Additions to the Roll 1193
The New President; Thanks to the Past-President; President's Address . . . 1194
The Amalgamation Scheme—Report by Mr. J. W. Helps 1198
Papers Read; Appointment of Scrutineers; The Autumn Meeting; Votes of Thanks 1205
Papers and Discussions—
Notes on Water Gas Manufacture. By Thomas Holgate, F.C.S., M.Inst.C.E. 1206
Purification, and Methods of Working Purifiers. By B. W. Smith, of Walsall 1214

TECHNICAL RECORD.

Water Gas and Other Combustible Gases . 1223
The New Works of the Southwark and Vauxhall Water Company 1224
Ohio Gaslight Association 1226

COMMUNICATED ARTICLE.

Gas Matters in the United States 1221

REGISTER OF PATENTS.

Gas-Governor for Incandescent Burners—Billing, M. B. 1229
Lighting and Extinguishing Gas-Flames—Simmance, J. F. 1229
Gas-Lighting Torches—Glover, J. G. . . . 1229
Gas-Igniting Apparatus—Schwarzenbach, J. 1229
Street-Lamp Lighting-Torches—Simmance, J. F., and Abady, J. 1230
Automatic Lighting Device for High-Pressure Incandescent Burners—Keith, J. . . . 1230
High-Pressure Burners for Incandescent Lamps—Keith, J. 1230
Means Whereby the Light in Incandescent Gas-Lamps may be Improved—Robinson, J. W., and Corsham, R. 1230
Coin-Controlled Meters—Craig, J. A. I. . 1230
Self-Igniting Attachment for Gas-Burners—Beese, R. 1231
Patent Notices 1231

CORRESPONDENCE.

Arsenical Poisoning from Beer 1232
Removal of Gas-Lamps by District Councils 1232

PARLIAMENTARY INTELLIGENCE.

Gleanings from the Committee Rooms . . 1332
House of Lords—Progress of Bills . . . 1235
House of Commons—Local Authorities and Water Undertakings; Directors' Right to Vote; The Derwent Valley Water Bill; Progress of Bills 1235
House of Commons Committees—
Mond Gas Bill 1236
Aldershot Gas and Water Bill 1242
House of Lords Committee—South Essex Water Bill 1243

MISCELLANEOUS NEWS.

Gas and Water Stock Market 1184
The Examinations in Gas Manufacture—The Question Papers at the City and Guilds of London Institute Examinations. . . 1244
Manchester Corporation Gas Supply—The Estimates 1244
Rotherham Corporation Gas Undertaking—The Past Year's Working 1246
Stock and Share List 1246
Southampton Gas Company 1247
Electric Lighting Notes 1247
Notes from Scotland 1249
Current Sales of Gas Products 1250
Coal Trade Reports 1250

PARAGRAPHS.

Institution of Civil Engineers—Annual Meeting of Italian Gas Managers—Blast-Furnace Fuels 1228
Buckley District Council and the Gas-Works—Gas Explosion in Leeds 1332
Rochdale Gas Profits—Ilkley Water Supply—Elland Gas Bill—Mansfield Corporation Bill 1235
Cromer District Council and the Water-Works—The Dissatisfied Gas-Workers in Carlisle—Sewer Gas Explosion in Manchester—Abertillery Water Supply . . 1244
Lambeth Water-Works Company. 1248
New Joint-Stock Companies 1251
Gas-Works Profits of Wigan — Another Manager's Defence of Gas—Sales of Shares—Water Supply by Meter—Malmesbury Water-Works Award—New Spiral-Guided Holder at Barry—Roumanian Petroleum—Projected New Gas-Works for Aberavon 1252

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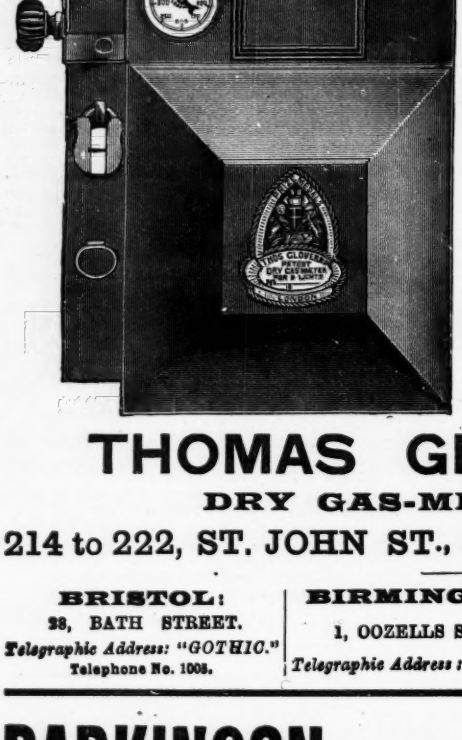

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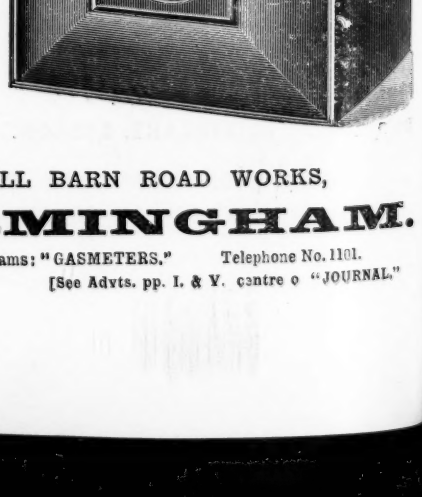

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JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

VOL. LXXVII., No. 1982.——TUESDAY, MAY 7, 1901.

EDITORIAL NOTES.

The Meeting of the Institution of Gas Engineers.

THE meeting of the Institution of Gas Engineers last week (held as usual in the hall of the Institution of Civil Engineers, Great George Street) was well attended, and was completely successful in all respects. The President who has succeeded Mr. James W. Helps in the chair—in itself no small test of personal ability and tact—is Mr. W. R. Herring, of Edinburgh; and it is not a mere compliment to state that he acquitted himself of the duties of his office with marked ability. Mr. Herring's address undoubtedly suffered in interest from the limitations which the President imposed upon himself for a variety of reasons. The chief thing his expectant hearers were thinking about, as they prepared to listen to the address, was the abortive negotiations for reuniting the gas engineering profession in one national society; and on this topic the President's mouth was properly closed. When it is remembered how slight a thing might have given offence where none was meant, in this connection, the presidential reticence must be adjudged to be policy of no mean character.

The same may be said in regard to the omission from the address of all mention of the work which the President is doing at Granton. All the professional world knows that Mr. Herring has in hand a task of the most responsible kind—perhaps the heaviest that was ever confided to so comparatively young an engineer to perform single-handed. He said not one word about it. Although this reserve, again, militated against the immediate interest of his address, it argued a feeling of modesty on the part of the speaker which is not too common nowadays, and is altogether commendable. It cannot strictly be said that Mr. Herring is among those youthful aspirants for distinction who can be described as just putting on their armour, inasmuch as he has already worn his harness for a considerable period; but he evidently has no desire to incur the reproach of speaking prematurely, as one who is putting his armour off.

Taking all the President's voluntary and imposed limitations into consideration, the address cannot be condemned as lacking in point or interest; and it was very cleverly supplemented by the contributions made by Mr. Herring to the discussions upon the papers submitted to the meeting. He introduced a laudable innovation upon the usual perfunctory presidential conclusions of these customary short controversies, especially on the occasion of the reading of Mr. Holgate's paper, in the shape of some apposite original matter. The example is an admirable one. As regards Mr. Herring's general conduct in the control of the meetings, there is nothing but praise to record. The occasion was one when the perpetration of a blunder would not have been difficult; but the business of the Chair was well done.

The chief topic of interest arising out of the meeting was, of course, the nature of the proceedings in regard to the proposed amalgamation of the Institution with the Incorporated Gas Institute. Readers of the "JOURNAL" will be able to recall how this matter was left the last time it was publicly dealt with, at the meeting of the Gas Institute in June last year. The official papers now published go further back, and tell the story of the negotiations from their commencement, by authority, down to what appears to be their very "lame and impotent conclusion"—for the time being. It is not to be supposed that the matter will rest where it is. There is another account to be rendered, by the other party to the futile negotiations; and until this has been done, we at all events shall abstain from expressing any judgment in the premisses. Remarks on cognate matters, made with the very best intent, in these columns have been so commonly garbled, misrepresented, and misunderstood in the past, that we do not at the present critical juncture intend to utter a word on the subject of these publications, besides recommending all whom they may concern to study the original text—including the last letter, which is new, and was only received yesterday. It is very interesting reading.

Of the technical work of the meeting there is not a great deal to be said. Gas engineers who, like Mr. Holgate and Mr. Smith, apply themselves to the collection and summarizing of authentic facts of contemporary practice, have their reward in the knowledge that they are doing good service to their generation; but they must also know that their matter can only be classified as controversial if it should happen to be wrong, which is not what they or anybody else would desire. What are regarded as "interesting" papers when they are read—daring suggestions, rash criticisms, and so forth—do not always so well justify their inclusion, at considerable expense, in the permanent record of transactions. Mr. Butterfield's excellent paper was enough to redeem the meeting from the charge of emptiness; and one good paper a year is as much as most technical societies can usually expect to obtain. The discussions at the meeting were very good; and that is really as much as to say that the assembly was justified by its fruits.

Mond Gas and Electrolysis.

THE Mond Gas Bill was in Committee during the whole of last week, and the proceeedings (as was to be expected) proved a powerful attraction to engineers who had come to town to attend the Institution meeting. A strong contingent of leaders of the profession was engaged, moreover, in following the progress of the Bill; and consequently it would have been difficult to say between the hours of 11.30 and 4 on Wednesday and Thursday, which assembly was the more fully representative of the personality of the gas industry of the United Kingdom. The coincidence of another Committee being simultaneously at work upon the question of electrolysis, formed an additional attraction to draw both gas engineers and electricians to St. Stephen's, and thus keep them away from Great George Street. The promoters of the Mond Bill finished their case on Thursday afternoon, and with a short and brilliant speech by Mr. Freeman, K.C., the Birmingham Corporation opened their opposition, and then called Mr. Charles Hunt in support of it. The cross-examination by the promoters foamed itself away against the solid rampart of hard facts built up by Mr. Hunt, Mr. Dugald Clerk, and Mr. Corbet Woodall. The luminous common sense of Mr. E. Orford Smith, the Town Clerk of Birmingham, who remembers the once-notorious Compressed Air-Power Scheme, and told the Committee all about it, formed a pleasant interlude to the intensely technical matters with which the patient Committee were plied on all sides. To-day the hearing is resumed; and the opposition to the scheme of the outlying Local Authorities and the Black Country Gas Companies will be taken in order. It is expected that two more days will see the Bill through, in one sense or the other.

The question of electrolysis is still in suspense. Perhaps the most satisfactory feature of the actual state of the question is the strong line that has been taken by so many leading electricians and electrical engineers in defence of street mains from electrolytic currents. Notwithstanding the narrowly selfish and, as we have shown on a previous occasion, unwarrantable pretension on the part of a certain section of the electrical trade interest, to pass judgment upon those English members of the electrical profession who are bold enough to hold that the responsibility for electrolytic injury to street mains should be placed upon those who create the risk, this is apparently the principle that will be followed. It will make it difficult for electric tramway and railway companies to carry on their operations after the American model; but with the admitted results of the working of the American plan before the world, he would be a bold man who should argue that they are such as a more staid civilization should tolerate. All that British gas and water suppliers want for their security is the extension to themselves of the English common-law protection which the King's lieges enjoy as regards the use of the highways. If a person is walking in the street and gets injured, through no fault of his own, by a wandering electric current, he can recover damages from the perpetrators of the injury, irrespective of whether these may happen to enjoy the possession of an Act of Parliament or a Board of Trade Licence, or can show that they are acting within a set form of regulations drawn up for their guidance. The mains of a gas or a water company, being in the roadway by virtue of statutory enactment

only, do not appear to enjoy this common-law protection. Not being lawyers, we cannot pronounce with any authority on this matter; but it seems, from what we are able to glean in the arid field of the law, that the American precedent quoted in these columns last week is not applicable to the case of a British gas undertaking, which exists by virtue of a different sanction. On the face of it, it appears anomalous that a wayfarer using the highway for his lawful purpose has a remedy for wrong done to his person or property which is denied to the proprietor of the pipe lying of right below the surface. The rights, however, are stated to be of a different kind; and if this is so, then it would appear to be reasonable that the more perfect should be copied for the protection of the less defended subject.

The Examination in Gas Manufacture.

In another part of the "Journal" will be found the text of the questions set to the candidates at the Examination in "Gas Manufacture" held last Wednesday by the City and Guilds of London Institute. We are very glad, and not a little gratified, to observe that the criticisms that have been passed upon the conditions under which the by no means easy papers set by the Examiners on these occasions had formerly to be answered, have not been unheeded. Prior to last year, it was customary to ask the candidates, both in the Ordinary and the Honours Grade, to answer every one of ten questions within the space of a nominal three hours; the allotted time being invariably slightly curtailed by that occupied in the giving out of papers, of reading through the questions, and getting under weigh. Thus a maximum of 18 minutes was allowed for the answering of each question—a condition of things which, as was pointed out, gave an unfair advantage to the rapid over the deliberate worker. At last year's examination, a move in the right direction was made by the restriction of the number of questions to be answered to not more than eight out of the ten set in each grade. The maximum average time allowed was thereby increased to 22½ minutes. This year, the further step has been taken of extending the time-limit from three to four hours; answers to eight questions only being required in each grade as at last year's examination. This gives practically a solid half hour for the writing of each answer—a very great improvement indeed upon the nominal 18 minutes of earlier years.

We are afraid the examining authorities will think us very hard to please; but, while fully recognizing the value of the amendments already conceded, we still, like Oliver, ask for more. We want to see this examination divided into two papers for each grade—one to be answered in one evening, the other in a subsequent evening. The fact is—and everyone who has been through the Guilds Examination will agree with us—that the mental strain involved is so severe, the tax on the nerves so great, that only an exceptionally constituted student can do himself justice towards the end. The first five or six of the questions are often answered more carefully than the last two or three, not merely because time is running short, but also because the examinee is clean fagged out. Let the authorities set aside two evenings, and give the students five questions to answer in three hours on each of these occasions, and we believe that the average quality of the papers written, and of the sketches made, will be found to improve considerably.

Upon the questions set last Wednesday, very little need be said. We would, however, remark that the absence from the Honours paper of questions the replies to which require the making of elaborate and involved sketches is satisfactory. Too much stress has, we think, been sometimes laid upon the value to a student engineer of the gift of making finished drawings in the stress of an examination—astonishment being expressed because sketches thrown off in the course of answering ten difficult questions in something less than three hours were frequently of a decidedly crude description. The value to an engineer of being able to make accurate and intelligible drawings to illustrate his ideas cannot be too strongly insisted upon; but the way to discover that ability is certainly not to ask him to illustrate the process of carbonizing and scrubbing, and to make drawings of a wet meter, a governor, and a gasholder tank, in the course of three hours, in which he is also to cover eight or ten pages of foolscap. We are glad this fact is becoming recognized. Sketches were, we note, only asked for this year in one question in the Ordinary, and in three (of the ten) questions in the Honours, Grade.

Before leaving the subject of the Guilds Examinations, we would here draw attention to, and endorse, the plea made by Mr. Herring, in his presidential address last week, for a more generous and a more speedy recognition by employers of successes achieved in these Technological Examinations by those in their service. As Mr. Herring truly says, to tell a young fellow who is spending the whole or the greater part of his leisure time in qualifying to fill a higher position, that some day he will be compensated, is not only unfair to that particular workman or member of the staff, it also serves to discourage like efforts in the general body of employees. Now, when more than ever experts rather than amateurs are wanted on the works, as managers and as departmental leaders, it cannot be too emphatically urged that "every "inducement should be given in hard cash to encourage the "technical training of the whole of the staff from the lowest "to the highest, and that it is only by giving direct monetary "advantage that the majority will be induced to follow it." Unfortunately, there are conspicuous instances in the gas industry where the desire to qualify for, and the display of ability to fill, higher positions, are resented and ignored by those already occupying them, with the not unnatural result that, while the pick of the rising men find scope for their talents elsewhere, those who remain make little or no effort to increase their value to their employers.

The Export Duty on Coal.

The great speech of the Chancellor of the Exchequer on the proposed Export Coal Tax, delivered at Thursday's sitting of the House of Commons, will live in history. It was a strong, well-reasoned, absolutely faithful and fearless presentment of an unexceptionable case for the imposition of a new tax upon a commodity that can well bear it. At the present time, when a grave National and Imperial emergency, having already been met at a heavy cost in blood and suffering, has to be paid for in cash, the public performances of one only of the agencies selected for contributing a portion of the necessary funds—the colliery interests—have been contemptible. Some coalowners who have been lining their pockets for long months, and colliers who have picked up the crumbs of their prosperity—utterly regardless of the protests of the helpless consumers of coal from whose need they exacted an increased price of 8s. per ton all round—are now whining and raging at the prospect of a shilling tax upon so much English coal as goes to the foreign market. The payers of income-tax, who have also paid doubled coal bills and higher gas accounts, are bearing their heavy burden as Britons should. The consumers of sugar, who will really feel a tax upon this necessary of life, do not cry like babies. But the coal people, who cannot show that they will feel more than the wind of the shot from the Treasury, are exhibiting a base spirit. They were not loved for their greed of the last two years; now something else will be added to the feeling with which their countrymen regard them. For the protests of the Trade Union miners, it may be said by way of explanation, if not of excuse, that they are in the hands of their professional leaders, who are giving a political twist to the whole agitation. The coal-owners, however, ought to know better.

The Chancellor's speech is mentioned here for the assurance it contained that the coal tax is not intended to be a temporary expedient. That is just what the country and the great coal-using industries wanted to know. Permanency is a virtue in a fiscal arrangement of this kind. It may be reassuring to people who are dubious as to the economic bearings of the duty, to learn, on the authority of Professor Marshall, of Cambridge, that it is not to be condemned on general economic principles. He defends the duty, on the ground that it is levied on a commodity with which the foreigner cannot easily dispense—in this case, our unequalled steam and gas coals. It is, he says, twenty-five years since he thought of writing to advocate an export duty on coal, but was restrained by fear of the imposition of retaliatory duties by other countries. This consideration does not appear to have weighed with the Chancellor of the Exchequer, whose courage Professor Marshall admires. It is, indeed, no time to weigh these conceivable risks too nicely. The country needs revenue; the foreigner needs our coal—and coke. Therefore, let him pay for it. He has been getting both, especially the latter, far too cheaply.

Our correspondent of last week who calls himself "Free "Trader"—that blessed term!—must deal with Professor Marshall. It seems to be the rooted conviction of economists of his order that the British consumer pays all duties that are required to defray the national expenses. It is a nice conclusion that the export coal duty will amount to a protective duty of 2s. 6d. per ton on German iron imported

into this country. If so, we must try and "bear up." Our correspondent has overlooked the first step of what should have been his argument—proof that British coal occupies the same economic position as other exportable commodities. This is not really admitted by anybody who is worth hearing on the subject. Professor Marshall's letter will be found in "The Times" for the 22nd ult.

Parliament and Directors' Votes.

The House of Commons came into conflict with the forces of Directordom last week, and with mixed results. It began with a Bill of the London and North-Western Railway Company, which was down for second reading in the ordinary course. Time was when the House as a whole would not meddle in these matters of private business, which the majority of members never professed to understand. Things parliamentary have greatly changed of late years, however; and now, as many statutory companies have good reason to remember, the House of Commons undertakes to settle most questions of principle arising in respect to Private Bills. Thus it was that, on the motion for the second reading of the Bill in question, objection was taken that the Company had set Parliament at defiance in regard to the model clause dealing with the re-housing of persons of the working class who may be displaced by the Company's operations. It was alleged against the Company that when they provided fresh accommodation for the people whose domiciles they cleared away, it was not always at the same rents as were previously paid by them. In point of fact, the Railway Company were impeached for doing precisely the same thing as the London County Council have invariably done in their housing schemes, and have taken credit for both in and out of Parliament. It was further asserted that the Company had essayed to drive the proverbial coach-and-four through the model clause, by purchasing house property privately. The net result was that the Company's "Omnibus" Bill was rejected on a division.

Then the House, or a large section of the members, proceeded to do a ridiculous thing, by impugning the action of those Directors of the Company, Members of Parliament, who had voted in the division. Of course, this raised the whole question of the legality and propriety of such votes; and there was a vast amount of nonsense talked on the subject. Attempts have often been made, in regard to parliamentary votes and the proceedings of local authorities, to distinguish between the voting of directors and ordinary shareholders, without success. The discussion on this occasion recalled the similar performance early in the history of the present Parliament, when objection was raised to directors of public companies holding any offices in the National Government. These controversies serve no other purpose than to bring into strong light the hypocrisy which is one of the unlovely characteristics of a certain order of Briton. It is preposterous to pretend that one man cannot give an honest vote because he happens to hold shares in a company more or less interested in the issue, whereas a paid servant of a Trade Union may properly interfere, in the interest of his masters, in the award of contracts, the fixing of rates of wages, and other very personal matters. Parliament properly rejected this suggestion; but it is certain to be revived again and again.

The Prospects of a General Strike of Coal Miners.

The adjourned debate on the report of the coal export duty resolution will probably have been concluded, and a further step taken towards the final confirmation of the tax to which the House of Commons has provisionally agreed, by the time this issue of the "Journal" is in the hands of our readers. A conference of the miners is to take place to-day to discuss anew the proposal for a general stoppage of work. Whatever may be announced as the decision of that conference, we do not believe any such stoppage will take place. The proposal, and the noisy support which is being given to it by many of the men's leaders, are, in our opinion, nothing more than bluff—bluff, however, which it is perfectly evident will be quite ineffectual. The Chancellor of the Exchequer is well aware of the facts that he has the majority of the House of Commons behind him, that the idea of a tax on coal is not displeasing to the general public—who are still suffering from the effects of the coal "boom," and who are quite indifferent to the arguments of political economists—and that those responsible for involving the country in the disaster of a general strike of coal miners without excellent cause shown would receive but scant sympathy.

We are glad to see that the "Iron and Coal Trades "Review" condemns the suggested strike in no uncertain terms. Discussing the proposal in an editorial article, our contemporary says: "For the moment, therefore, all other "considerations become subordinate to the question, What "are the miners likely to do? If their leaders advise a "general suspension of coal-mining labour, they will have "followed a course for which no censure could possibly be "too strong and no punishment too severe. No interest, "however powerful, is entitled to thus attempt to wreck the "general prosperity of the country, whatever the provocation "may be." In view of the attitude of some of the coal masters, this expression of opinion by the trade organ is very satisfactory. The "Review," we note, expresses entire disbelief in the statements made in the Daily Press that the coalowners, or some of them, are giving overt encouragement to the proposed general strike. "No coalowner has "anything to gain by such a course of action." It all depends—does it not?—upon what the coalowner thinks will be the result of the *threat* to strike. If he think it will, if made loudly enough, frighten the Government into surrender, he will undoubtedly in his own mind be sure that he has something to gain by encouraging the proposal, and will accordingly encourage it, though not intending to support it up to the striking-point. The danger is lest, having been so far encouraged, the men may go the whole way. But, as we have said, we doubt it.

Even if, however, extreme counsels prevail, and a general strike be ordered, is it certain that it can be made effective? Can the men employed in the collieries that do not live by the export trade, and will not be directly affected by the tax, be induced to strike against that tax? The miners in Wales, Scotland, Yorkshire, Durham, and Northumberland may be willing to deplete their Union exchequers in order to demonstrate their dislike of the new duty; but it is by no means certain that the men of Lancashire, Derbyshire, Nottinghamshire, Staffordshire, and Salop will be equally keen upon such a course. Moreover, the miners everywhere are looking forward to a tussle with the owners over the wages question, which is likely to arise all the sooner on account of the recently imposed duty. Are they likely to prefer opening the discussion with a diminished balance at the bank to starting it with the accumulations of the past two or three years intact? Not unless they are more foolish than we fancy them to be. In fact, the probabilities all point to the suggested strike fizzling out, and involving its projectors in well-merited discredit, now that it is obvious that the Chancellor of the Exchequer's nerves are proof against sound and fury.

The Devonport Gas-Works Purchase.

No official statement has yet been made as to the terms arranged between the Devonport Corporation and the Gas Company for the transfer of the latter's undertaking. It appears, however, that the agreement is not unlikely to be satisfactory to the Company, and that the shareholders will realize the full value of their investment. The price to be paid is to be determined by arbitration; but the arbitrator is to take as a basis the sum of £4400, the amount which the Company have been distributing in dividends. This concedes to the holders of the £15,000 of "additional shares" the 10 per cent. dividend which they have been accustomed to receive since 1871, instead of 6 per cent. to which the Corporation contended they were only entitled. It also leaves out of the calculation the question as to the payment of dividend free of income tax, which was another point made against the Company. The reserve fund of £5000 is to be taken by the Company; but, otherwise, all the assets and liabilities will pass to the Corporation. Until the date of the transfer, the Company are not to incur any expenditure on capital account without the written authority of the Town Clerk. The usual provision is made for compensation to the Manager and Secretary for loss of office if they should be displaced; and there is also a specific arrangement that Mr. A. Bennee, who filled for some years the position of Managing-Director, and more recently that of Chairman of the Company, is to receive under the Bill a pension of £150 per annum.

The Cape Town City Council have decided to separate the offices of City Engineer and Water-Works Engineer, now held by Mr. R. O. Wynne-Roberts, and to leave with him the duties appertaining to the latter office only. A City Engineer and Surveyor is to be appointed, at a salary of £1000 per annum, with a gradual increase to £1250.

WATER AFFAIRS.

Additional Water Storage in the Thames Valley.

In another part of the "Journal" will be found an account of the inaugural ceremony in connection with an undertaking which cannot but have an important bearing upon the health and well-being of the inhabitants of the Metropolis. On Tuesday last, the Chairman of the Southwark and Vauxhall Water Company (Alderman Sir Henry Knight) made a formal commencement with two new reservoirs at Walton, which will give the Company additional storage to the extent of 1076 million gallons, and bring up their total to 1512 millions, irrespective of 71 million gallons of filtered water; making in all 1583 million gallons. They will then have at their disposal sufficient water for 58 days' supply, without abstracting a drop from the stream. On the same occasion, but earlier in the day, water was turned for the first time into a new series of filters at the Company's station at Hampton, on the north side of the river. This latest addition to the filtration plant of the Company, of which there are now three sets at Hampton, brings up the number of beds to 31, each of the capacity of about an acre. It will thus be seen that the Directors have made, and are still making, not only provision for keeping an ample supply of water at their command, but for ensuring that its quality shall be such as not to give rise to complaint from the most exacting medical officer or the most scrutinizing analyst. And while they have been careful to enlarge their works in the two important directions indicated, they have not been unmindful of the fact that their commodity has to be sent a dozen miles to the Metropolis. Attention has accordingly been given to the pumping plant. The light and well proportioned engine-house, equipped with the three magnificent triple-expansion engines of which we give illustrations today, bears testimony at once to the ability of the Directors and the skill of their Engineer. The three engines designed by Mr. Restler for this house, which were much admired by the visitors to the works last Tuesday, will lift 27 million gallons of water per day under a head of 280 feet; and it is conveyed to its destination by mains of adequate carrying capacity.

We have been dealing with only one station of the Company. True, it is the most important; but the others are valuable auxiliaries. Combined, they place vast resources in the hands of the Directors; and it will therefore be interesting to see how they deal with them—not merely for the sake of making dividends for the shareholders, but in the public interest. The London Water Companies have always been regarded as good objects of attack; and lately they have come in for a more than usually large share of abuse. Individually as well as collectively, they are reviled upon the platform; and, with very few exceptions, the Press does not lose an opportunity of pouring upon them columns of vituperation. The introduction of the revised regulations, necessary and fully justified as they undoubtedly were, afforded such an opportunity to the so-called "leaders of "public opinion;" and the recent rejection of the Purchase Bill of the London County Council has furnished certain popular orators with a subject on which to "educate" the public, though it is one upon which they themselves might be better informed. For example, at a public meeting held in Battersea last Friday, to protest against the action of Parliament in rejecting the Council's scheme for dealing with the water supply of London, the Mayor (Mr. W. Davies) is reported to have prescribed the formula of "more water of "a better quality and on more reasonable terms" as embodying the views of those present as to the requirements of London in general—and, we presume, Battersea in particular—in the matter of water supply. Now, what are the facts in regard to the Company with which we are now specially concerned? Their area is rather more than fifty square miles in extent, and they supply 124,770 houses, containing a population of 837,206. The average quantity of water sent out daily last year was 32,366,860 gallons; being an average of 38·83 gallons per head. This "shamefully in-"adequate" quantity of water, as it is frequently termed, is furnished to a £20 house for 20s.—or, reckoning seven persons per house, for 2s. 10d. per head—per annum. So that for less than 3d. a month (the price of a pint of beer) the working man is able, by merely turning a tap, to get a great deal more water than he will require for his use, and of a quality which is pronounced by chemists of the very highest standing to be, on the whole, well suited for all domestic purposes. It is acknowledged by competent authorities that in no city in the world is the water supply so closely scrutinized as in London. On the points of both price and quality, therefore, the formula seems to need reconstruction.

We have somewhat digressed from the subject of the provision of additional storage for water in the Thames Valley; and yet the extended works at Hampton and those now in progress at Walton must have due consideration in the discussion of the general question of the water supply of the Metropolis. They furnish evidence of the desire of the Company who are carrying them out to faithfully discharge the duties entrusted to them by Parliament. On the other side of the river, but much higher up, the Contractors for the new reservoirs of the Southwark and Vauxhall Company (Messrs. John Aird and Sons) are pushing on very rapidly with the works which Messrs. Hunter and Middleton are engineering for the Staines Reservoirs Joint Committee, and which, by a curious coincidence, were formally commenced on the last day of April three years ago. With their completion, provision will be made for the storage of 3300 million gallons of water, which will be at the disposal of the three Companies associated in that scheme. The Hampton and Molesey reservoirs of the Southwark and Vauxhall, Chelsea, and Lambeth Companies will contain 3628 million gallons of water; while those in the Lea Valley constructed by the much-abused East London Company, and in North London will hold some 7868 million gallons. Adding the 276 million gallons of filtered water, a total is reached of 15,072 million gallons, or about 70 days' supply. With this quantity of water available at our doors for the use of a population which the preliminary census returns published last Saturday show will be much below Mr. Middleton's estimate, the question once more arises: Whence comes the necessity for resorting to distant places for an auxiliary supply at enormous cost to the public? The answer is obvious. Then supposing the Companies' undertakings were transferred to a Water Trust or to the London County Council, would the consumers get any better and cheaper supply than they now receive? We may leave the facts and figures cited above to furnish the answer.

THE GAS AND WATER STOCK MARKET.

(For Stock and Share List, see p. 1246.)

The predominating feature of the week's doings on the Stock Exchange centres in the American market, where there has been an immense amount of speculative dealing; but that has no bearing on gas affairs. Generally speaking, the prevailing tendency was fair and cheerful; and prices tended upward—Consols and the gilt-edged division leading with a small advance. Business on the whole was not as abundant as it might have been, having been cut in halves by the Mayday holiday fixture falling on Wednesday. In the Gas Market, business aggregated to a point well below what might be called a fair average; and it was not characterized by any remarkable feature. But there was a good solid tendency, and prices were very steady throughout, with here and there a nice advance. It is not usual for the market to look very far ahead into the future, and generally the next dividend period is the limit of their horizon; but it would really appear as if heed were already being given to the effect upon the fortunes of the Companies which the great fall in the price of coal will have. It is true that the resultant benefits will only now be beginning to accrue, and will only show themselves next year in the matter of divisible profits; but that is not too far to look ahead. Dealings in Gaslight issues last week showed that the ordinary was very steady, with moderate business every day, changing hands at good middle figures, or a trifle better. Of the secured issues, the preference was the most active; but it did not look like rising. South Metropolitan was in great favour, and marked 133½ more than once, with a point gained in quotation. A few transactions in Commercials indicated steadiness. The Suburban and Provincial group were a very quiet market, but strong; and British and Tottenhams achieved advances. Locally, Bristol was lowered. There were hardly any dealings in the Continental Companies; and they presented no feature. And the same may be said of the remoter undertakings, where a slight advance in Cape Town debentures was the only movement. The Water Companies were again wholly devoid of any feature of interest; and a small rise in Southwark debentures was the only change in quotations.

The daily operations were: On Monday, there was small business in Gaslight ordinary, and in hardly anything else. Quotations did not move. Tuesday was not much more brisk; but South Metropolitan rose 1. On Wednesday, the Exchange was closed. On Thursday there was much more doing, mostly in the Metropolitan Companies. British rose ½, Tottenham old 3, and ditto new 1. Friday's business was nearly all in Gaslight, without any change. In Water, Southwark debentures rose 1½. Saturday was quiet and unchanged.

INSTITUTION OF GAS ENGINEERS.

PROCEEDINGS AT THE GENERAL MEETING,

HELD AT THE

INSTITUTION OF CIVIL ENGINEERS,

MAY 1ST AND 2ND, 1901.

Mr. W. R. HERRING, M.Inst.C.E., of Edinburgh, President.

REVIEW OF PROCEEDINGS.

A very fair muster of members of the Institution of Gas Engineers greeted the retiring President, Mr. James W. Helps, on the brightest of bright May mornings, in the hall of the Institution of Civil Engineers. Ever popular, Mr. Helps has undoubtedly increased his reputation with his professional brethren by his conduct in the chair of the Institution during an arduous and trying year, when extraordinary demands were made upon the tact and self-abnegation of the President. Although in one important regard, feelingly touched upon in his own few words of farewell, Mr. Helps has to confess a disappointment of the hopes with which he succeeded to office, there is not a man in the ranks of the Institution—hardly in the country—who does not realize that this failure would have been converted into a triumph if a peculiarly agreeable personality, animated by the heartiest good-will, could have saved the situation.

A cordial welcome was extended to the new President, Mr. Herring, who experienced the unique gratification of taking the chair of a professional meeting in the noble lecture theatre of the Institution of which he had just been elected a full member, on his conspicuous merits, without passing through the customary inferior grade. Not many minutes were occupied in complimentary speeches and formal business before the President rose to read his address, the text of which we publish in another column. To speak frankly, it is better to read than it was to hear, partly owing to noises outside the hall, and partly owing to the inability of the reader to catch the right tone for making himself well heard in all parts of the chamber.

The Presidential Address was conceived in a commendably modern spirit. Recapitulation and the reviewing of accomplished facts in the history of the Institution and the gas industry were renounced at the outset. The President well said of the latter kind of mental exercise that it is part of the daily task of responsible engineers, who must ever be basing their arrangements for the future on their experience. It is rather to be regretted that after so promising a start, Mr. Herring did not forthwith grapple at close quarters with some of the problems with which the gas engineer is confronted at the present day, instead of dallying with a number of general topics, which, to speak the truth, are not susceptible of better illumination from the latitude of Granton than from other head-quarters of professional light and leading. There is not much help to be derived from the observation that the Victorian Era "may "be said to have been a truly industrial epoch within which "many scientific enigmas have been elucidated and made "applicable to the industrial life of the country."

For this reason, a good slice of the first part of the address went over the heads of the audience. If it was expected that Mr. Herring would take the opportunity for telling what he has been doing for gas in Edinburgh, then in that respect the address must be judged disappointing; for it did not contain one word about the Granton works. A little more of the personal note would have materially heightened the interest of the composition. It is, however, not a pleasant exercise in criticism to point out what an author has omitted to say; although men are, as a rule, more severely condemned for sins of omission than for acts done. Possibly Mr. Herring had his reasons for keeping silence respecting his personal doings—modesty being among the number. But if this was the case, his address suffered sadly from the lack of point resulting from this reticence.

Mr. Herring proclaimed his adhesion to the principle of low-grade gas supply, even going so far as to declare that "the necessity to continue supplying an illuminating gas "has ceased to exist." But, of course, he admitted that the community is not quite ready for a non-illuminating gas for general consumption. He had nothing to say upon the question of how much the emancipation of the gas industry from the tyranny of the photometer is likely to affect present methods of gas manufacture. He rightly stated that at the outset, the new ideal cannot simplify present gas-works methods to an appreciable extent; but that is an obvious truth. A technic that has been rigidly tied to one standard of meritorious performance ever since its inception cannot be revolutionized off-hand; but the problem thus slightly passed over by Mr. Herring is the chief and almost the only thing worthy of the attention of the best technicians of the time.

It would be a worthy exercise for any earnest student of gas manufacture to look up all the records of old endeavours to break through the rigidity of coal carbonizing routine with the object of cheapening the process and increasing the production of gas. Carburetting and labour-saving have been the objects of most modern improvements in gas manufacture. But it was not always so; and certain old notions about gas-making that appeared before their time may contain some instruction in them for present-day workers for the future. Actually, there is a vague idea floating in contemporary gas engineering opinion that coal carbonization in bulk, with admixture of water gas during the process, offers the best promise for the manufacture of the cheap gas of the future. Mr. Herring touched upon this suggestion in passing, but without offering any criticism upon it. Yet he is building a great modern gas-works for Edinburgh. Without offering an opinion upon the wisdom of this reserve on his part, the fact is worth noticing as an illustration of the slowness with which radical changes in methods of gas manufacture are likely to proceed in the United Kingdom.

The address went on to refer to the general complaint of the reluctance of young men of the right stamp to take to the gas industry for a livelihood. The reason is in the main, as the President admitted, that the emoluments, especially in the middle ranks of the profession, which are those manned by subalterns of considerable length of service, are insufficiently attractive. The positions of assistant-engineer, of deputy-manager, works superintendent, draughtsman, works chemist, and the like are neither distinguished nor adequately paid. Unfortunately, a man may remain in such a groove for years without being able to get out of it. If he stays on too long, the chances are against his ever rising higher. In this case, he ought to be paid enough to live upon, and marry, under conditions conducive to the maintenance of his self-respect and the enjoyment of reasonable content with his lot. This was really the best matter of the address; and we must dwell a little upon it. What prospect is there of the larger gas undertakings, where the manager has need of competent assistance, offering adequate salaries for the right class of men—even assuming that the chief himself is reasonably well paid? It will be noticed that Mr. Herring does not discuss the pay and position of the engineer and manager, upon which Mr. Corbet Woodall had something to say not long ago. He confined his attention to the hard case of the qualified, but ill-paid, assistant.

The first question that arises in this connection, and would appeal to the controllers of the purse-strings in board and committee rooms, is that of value for money. In the long run, let us say, the responsible heads of every industrial concern are paid by results. In some instances, in the gas industry, this is formally the case; but more often the services rendered by men who really do engineer and manage the business well are recognized by a rising salary. The men who have most cause to complain are those who do not enjoy the confidence of their boards or committees—not necessarily through any fault of theirs—and are consequently over-ridden by their superiors. In this case, the nominal manager is usually ill-paid; while the board or the committee, who do the most responsible part of what should be his work, think they pay enough. Assistants are by virtue of their office subordinates; and their paymasters are apt to think more of their cost than of their possible value. It is a case of balancing positive working expenses against problematical advantage. If it is none too easy to appraise the money's worth of good management, it is much more difficult to put a fair price upon reliable assistance in control.

The only fair way is to attach a reasonable salary to the position, and not attempt to value the precise worth of the incumbent. There ought to be a good staff of officers employed in every gas-works above the smallest, where

the manager must be single-handed. If there are several stations belonging to the undertaking, they should all be in the hands of officers of commission rank; and the chief general assistants should be men of recognized position, and decently paid. Salaries do not bulk much in the cost of gas making; and, unfortunately, the biggest undertakings are, in some instances, the most penurious and the hardest upon their subordinate officers. Some that could be named are disgracefully mean in this respect; and there is not a little consolation in the reflection that they are not in the best odour or the most successful in business.

Mr. Herring laid stress upon the need of good commercial methods as well as technical skill in the conduct of gas undertakings. This is conspicuously true; and the saying is not the less weighty for having been used many times before. The rigidity of monopolist manners has become a tradition of many gas offices, which are consequently unable to do business as it should be conducted. A man may be an excellent book-keeper, without knowing how to strike a good bargain. An able engineer may be by temperament unable to fathom the unexpressed wishes of a body of gas consumers. A gas undertaking living under statutory protection might shelter both these men; whereas, under the rule of competition in trade, they would be "out of it." There is plenty of work in the gas industry for able accountants and strict engineers; but they should be supplemented by acute commercial spirits. This is, of course, the justification for the new fashion of appointing special shop-keeping agents for gas companies in certain towns. What the atmosphere and the traditions of the gas offices prevent being carried on directly in the establishment, can be delegated to accredited outsiders who have been trained in the bracing air of trade competition.

The subject of administrative discretion and managerial judgment was duly mentioned by Mr. Herring. It is desirable that the management should know when to "scrap" old plant and machinery; how much money can be properly spent to save money; and where to draw the line between wise progress in the adoption of new ways of doing work and merely pedantic mechanicalism. As Mr. H. E. Jones said the other day, in a gas-works the man with a shovel and barrow is the best of all machines for many purposes—if he will but work as well as he is reasonably able. Inasmuch as no industrial concern can hope to be always in good hands, Mr. Herring contends for a wider recognition of the expediency of writing off misspent and obsolete capital. This is a large order. He holds that it is the first duty of a municipality after acquiring a gas undertaking to make the capital account agree with the structural value of the investment. After this, any balance of profit is the property of the consumer, to be applied for his benefit by reducing the price of gas. This is sound doctrine; but the amateurs of Municipalism would probably argue that the acquisition of gas property upon such terms would usually not be worth the doing.

The address showed in a few words that, in the matter of duty in lighting power for the money invested, the gas industry stands far higher than electricity supply. Still, it is admitted that price is not everything, and that electric lighting has become fashionable irrespective of its higher cost as compared with gas. This is notoriously the fact; and we have always admitted that it would be so, wherever people can afford to pay for their fancy. The prime condition of commercial success for electric lighting lies in finding enough people of this way of thinking in the same locality. Mr. Herring had something to say about the desirability of establishing sympathetic relationship between gas suppliers and the owners of building estates. He makes his staff of inspectors responsible for keeping the gas office informed as to the extension of building operations—a good idea.

References to the Paris Gas Congress and the forthcoming Glasgow Exhibition brought the address to a sufficiently "topical" close. Oddly enough, one of the rare practical points which the President condescended to make in the course of his address emerged within a line or two of the end, where he drew attention to the different circumstances of British and Continental gas-works in regard to the reliability of coal deliveries in their respective cases, which difference is naturally reflected in the diverse arrangements found necessary for the provisioning of the works. It is scarcely likely that our English gas-works will err on the side of extravagant storage of raw materials. They have not, as a rule, the room for it; although many might do better in this respect than has hitherto been their habit. It might enable them to occasionally return a consignment of so-called coal that proved to contain an undue proportion of stones and dirt.

The most important business of the meeting was taken immediately after the conclusion of the President's Address. This consisted of the consideration of the report prepared by Mr. Helps, at the request of the Council, upon the amalgamation proposals and negotiations, which it is safe to say have occupied throughout the past year a prominent place in the minds of the majority of the members of the gas engineering profession in the United Kingdom. How to restore harmony to the divided household of the profession has appeared a problem, apparently, of form rather than of principle. Upon the desirability of reunion, all seemed to be agreed. At any rate, nobody ventured to give public expression to the contrary opinion. Still, underneath the surface, there has all along been a good deal of resistance to the even flow of the movement towards the point where the independent existence of the two national organizations would terminate. It would not be true to state that this internal resistance was felt in one body only. On the contrary, it permeated both, and was concerned with considerations of sentiment as well as of practical politics. Not to go into these matters too deeply, it may be said, shortly, that the upshot of Mr. Helps's report on the whole subject is that, after two years of correspondence and negotiation, the resisting forces—whatever their nature and origin—have for the time prevailed; and the official movement towards unity has consequently ceased. With this statement of fact, it will be better to leave the record to speak for itself. Especially is this reserve expedient by reason of the consideration that the issue remains, so to speak, *sub judice;* members of the Gas Institute having still to receive and deal with the corresponding report of their own Council on the same proceedings. It is worthy of remark, meanwhile, that, notwithstanding the failure of the protracted negotiations to bring the desired end any nearer, the members of the Institution, while unanimously and warmly supporting the action of their Council throughout these proceedings, gave ample expression to the fact that they had not gone back upon their original declaration of adhesion to the principle of unity. Neither have they, as a body or individually, abandoned their deliberate, reasoned, and clear convictions with regard to the nature of the steps to be taken for carrying the principle into effect. Obviously, unless the proclaimed desire for unity of the members of the gas engineering profession of this country is to remain a mere pious opinion, like that which is directed towards the dream of the Union of Christendom, or the other which admires the idea of the Federation of Mankind, some executive form must be clothed upon it. Herein lies the actual difficulty, which no single party to an attempt to find such a form can expect to dispose of according to taste. [Since the above was in type we have received a copy of a still later letter of the series—written by the Secretary after the Council of the Gas Institute had had the opportunity of considering Wednesday's proceedings. It came to hand yesterday, and will be found at the close of the discussion on the amalgamation question in our general report of the proceedings.]

The first paper read was Mr. Holgate's useful summary of the actual state of the technic of water-gas manufacture. From the nature of the subject-matter, this was not a very debateable contribution to the proceedings of the Institution; but nobody who recognizes the author's reputation for painstaking and accuracy in the collection and noting of technical points, will require to be told that Mr. Holgate's paper, albeit distinctly of the "dry" order from the point of view of a meeting held indoors in May, is really very valuable. It evoked some useful additions to the available stock of information relating to the subject, from several members well qualified to speak upon it, including the President, whose statements of the cost of carburetted water-gas making over a series of periods ending last March, were particularly worth having. Even he, however, like most makers of carburetted water gas in gas-works, is disposed to be too kind to it, in omitting to charge against it a due share of the gross costs of carrying on the undertaking. Mr. B. W. Smith's paper, in a way, resembled Mr. Holgate's as regards its intention and general character. That is to say, it is a collection of facts and observations more or less expository of contemporary practice in the technical matters to which it relates, without professing to be a complete compendium of knowledge of the subject. It was usefully supplemented by remarks from Mr. C. C. Carpenter, Mr. H. Iago, Mr. Helps, Mr. A. F. Browne, and other works managers with

whom sulphur purification is a very urgent consideration. The discussion marked a distinct advance towards the adoption for large works of what ought in fairness to be styled Mr. Henry Green's system of purifier construction. Mr. C. E. Brackenbury's paper on differences observable between English and Continental practice proved to be somewhat irritating to his audience. Nothing like enough was said as to the influence of the old concession system upon the older gas engineering of the European Continent, from which the excessive elaboration and costliness of the newer works constructions is the almost inevitable reaction. In the course of the discussion, Mr. Hawkins, of Todmorden, published a useful hint as to the best way of getting gas out of inclined retorts. Mr. King, of Liverpool, said all that was necessary on the question of ornamental gas-works design and construction; truly remarking that cleanliness and neatness are the best ornament in such cases. It is not making an invidious distinction to classify Mr. W. J. A. Butterfield's as the best paper of the meeting. It contained a mass of useful and suggestive information on the working of water-gas plant, thoroughly well digested, and placed before the auditory in the clearest way. It is high time that British gas engineers who use this kind of gas-manufacturing apparatus should drop their "leading-strings," and treat the work as masters. Hitherto, British gas undertakings have been wisely content, as a rule, to pay for the experience of foreign instructors in this department of their manufacturing operations. The minority, who ventured upon untried plants and methods in this connection, mostly had reason to repent of their temerity. But that stage of technics has, or should have, passed. The standards of ordinary "shop" efficiency, or of contractors' efficiency, ought to be discarded for rational rules of working, based upon known possibilities. Towards the realization of this advance, Mr. Butterfield's paper should sensibly contribute.

The remainder of the ordinary proceedings of the meeting do not call for detailed comment. The adhesion of members was solicited for the Engineering Congress to be held in Glasgow in September. The excursion on Friday, to Dover, was favoured with brilliant weather, and was well attended. The chief attraction was the great harbour extension works, which, when successfully completed, will be a triumph of artificial masonry construction.

THE PROCEEDINGS SUMMARIZED.

[*The Usual Full Report Commences on p.* 1193.]

There is a feature about most of the annual gatherings of the Institution upon which the members ought to be congratulated; and it is that the weather on the opening day generally is most auspicious. May-day this year was no exception; and members put in an appearance at the meeting in goodly numbers, and evidently one and all were exhilarated by the radiancy of the morn. In the lobby of the Institution of Civil Engineers, where they foregathered, cheerfulness and hearty greeting abounded. By 10.30 the retiring President (Mr. J. W. Helps) was in the chair; but his stay was of short duration, as all he had to do was to see the completion of the formal business (of the greater portion of which the programme had been disburdened at the February meeting) and to introduce his successor. The year of Mr. Helps's office, let it here be said, has been an arduous one; and it is almost a marvel how (when we remember how sorely he has been troubled apart from professional cares) he has succeeded in discharging the work which he has so willingly taken upon his shoulders for the profit of the gas industry. He has, in the first place, performed the ordinary duties as President of the Institution with exceeding earnestness; unwearied he has taken a prominent part in the negotiations which it was hoped would have resulted before this meeting became due in the gas profession being in a fair way of becoming united in one solid organization; he took a dignified share in the work of the International Gas Congress in Paris last September; he has since taken upon himself the Honorary Secretaryship of the Gas Section of the Engineering Conference in Glasgow; and withal he has not neglected his duties as Honorary Secretary of the Southern District Association. This is a record of self-sacrifice for the gas profession unequalled by any man during the past year; and as Mr. Helps rose to open the proceedings on Wednesday these things, we have little doubt, flashed through many minds, and acknowledgment of worth and work found expression in cordial acclamation.

The annual report and the statement of accounts and the Scrutineers' report (which announced the election of three new members and an equal number of associates) were quickly disposed of; and then Mr. Helps introduced his successor, Mr. W. R. Herring, of Edinburgh. Flattering, but just and true, were the words he used. Mr. Herring, he said, has done good work in the South, has done good work in the Midlands, and now is doing excellent work in the North; he is determined to write his name very legibly on the records of the gas industry. Applause was showered upon Mr. Herring as he entered into the high and honourable office to which he has won his way by sheer hard work and merit. This gratifying incident ended, Mr. Helps was not permitted to depart without a record being made in the Transactions of the Institution of the indebtedness which the members all feel is due to their late President. Mr. C. C. Carpenter was their mouthpiece; and, in appropriate phrase, he spoke of the devotedness of Mr. Helps, and moved a resolution embodying the thanks of the members. The motion was seconded by Mr. H. Iago, and enthusiastically endorsed. Satisfaction with the year's work was the main point in Mr. Helps's acknowledgment; but in a tone which reflected the sincerity of his words, he regretted that a "certain matter" which had engaged much attention during the year had not been consummated.

The President's Address.

The address of the President is given *in extenso* elsewhere, and it is fully commented upon in the preceding "Review." Amid the great engineering problems and executive work appertaining to the large undertaking with which he is connected, he has found time to view and form an opinion on numerous current questions affecting the industry; and to these he mainly confined his address—practically ignoring the constructional work which has set him to the fore in the ranks of gas engineers. This is not exactly what was expected; but if any regrets are felt on the score, it may perhaps be some consolation to many of his friends to know that, in all probability, Mr. Herring will gratify them on at least one branch of gas engineering at the Glasgow conference in September next. The delivery of the address was somewhat marred by an almost incessant knocking by workmen apparently engaged on the roof of, or in close proximity to, the meeting place. Thanks were accorded to the President for his address, on the proposition of the Ex-President, seconded by Mr. G. C. Trewby.

At this point a considerable number of the members from the Midlands, whose presence was required in the Parliamentary Committee room where the battle over the Mond Gas Bill was being waged, had to leave the meeting.

Amalgamation Question—The Gas Institute Departs from the Original Basis of Negotiation.

Of the whole of the proceedings which followed, of capital importance was the report prepared by Mr. J. W. Helps on the long-debated question of the proposed amalgamation of the Institution and the Gas Institute. The report was read by its author; and the discussion consumed the remainder of the morning sitting. The statement on the course of the negotiations occupied fully six octavo pages of printed matter, and an additional sixteen pages set out *in extenso* the correspondence which has passed between the heads and Councils of the two bodies. So that our readers may have the whole story, we have reproduced it in our general report of the proceedings. The history of the negotiations is told from the commencement in June, 1899, down to the present time. Up to a certain point in the treaties, the principle of the exclusion of traders and the necessity for dissolution were accepted without dissent by both sides. Then matters were carried so far that a Joint Committee of the two bodies drew up a set of rules for a new society to be composed of members of the Institution and Institute, except such as were engaged in trade. The scheme and rules were accepted by the Institution at their meeting in May last year; and what happened at the meeting of the Institute in the following month will be fresh in the minds of readers. The scheme all but passed; and it was only on the resolution for the voluntary winding up that it was eventually wrecked—the feeling being that there were certain gentlemen connected with the commercial side of the gas industry whose previous honourable work in the profession of gas engineering entitled them to a place in the suggested new organization. But after the excitement at the Institute meeting had abated, the Council

were requested to continue their efforts to secure a satisfactory settlement. The next step was the passing of a resolution by the Council recommending the addition to one of the clauses of the draft Memorandum of Association of certain words which would give to the Council of the new Association power to re-elect or elect certain gentlemen who, at present belonging to the Institute or Institution, would not otherwise have been eligible under the new rules. Later in the year, being wishful of meeting the views of the Council of the Gas Institute, the Council of the Institution asked them to submit the names of the gentlemen whom they were desirous of retaining. But there seems to have been a little evasion of the point on the part of the Institute Council, inasmuch as they replied that the naming of those whom it would be desirable to *exclude* from the new society presented many difficulties. This was the reverse of what they had been requested to do. Conferences and correspondence ensued, which resulted in the Council of the Institute being asked to submit their requirements to the Institution in writing. This they did on Feb. 26; but in their letter the Council transferred themselves to an entirely new position. Principles laid down at the earlier conferences—that dissolution was necessary, that those described as traders should not be admitted to membership, and that neither the name of the Gas Institute nor that of the Institution should be selected as the name of the new Association—were all ignored; and the scheme suggested resolved itself into a voluntary liquidation on the part of the Institution, and a transference of its members to the Gas Institute. This, Mr. Helps pointed out, was a mode of procedure diametrically opposed to the views of the members as from time to time expressed.

No actual recommendation was contained in the report; the object of its preparation being to obtain the instructions of the members. But the President soon made clear the feeling of the Council on the subject. We cannot, he said, recommend such a sacrifice of principles as it would involve to do as the Council of the Gas Institute last of all suggest. We feel that only men actively engaged in the management of gas-works, or in their construction, should form an association representative of the gas profession; and we do not see our way to deviate from that principle. It has been with no uncertain voice or action that Mr. George Livesey has made it known that unity in the gas profession is a desire which he has closely at heart; and therefore it must have been with no little pain that he took upon himself the duty of moving a resolution approving of the action of the Council during the negotiations, and recording the inability of the members to accept the proposals of the Council of the Institute as contained in their letter of Feb. 26. He spoke of the members of both bodies as personal friends; but he reminded all concerned that, while they are divided as a profession, they cannot speak with such power as is necessary to enlist the public ear. Personal interests, he held, should not stand in the way of doing what was best to promote the interests of the gas industry. Full endorsement was given by the members to the remark: "But much as we are impressed with the importance of presenting a united front, it is impossible that we can accept the suggestion that we should simply be absorbed." The argument which has been raised, that traders are admitted into the Institution of Civil Engineers, was swept aside. There is no parallel, said Mr. Livesey. The members of the Institute and of the Institution are the responsible officers of gas undertakings all over the kingdom. They have the buying and selling of all articles used by their undertakings; and therefore, like Cæsar's wife, they should be above suspicion. A reference followed to the visit which he paid to the meeting of the Gas Institute two years ago, when a very strong feeling was expressed as to the desirability of amalgamation; but on leaving that meeting, in the lobby of the hall, Mr. Livesey found the traders very busy indeed—not mere travellers, but the principals in certain trading firms. "I do not blame these people," said the speaker, "but I do blame the system which, so to speak, compels them to attend to protect or look after their own special interests." He regards the last letter from the Council of the Gas Institute as an "insult" to the Institution; assuming, as it does, that the Institution is composed of a body of men who have no self-respect. The dictatorial tone of the letter displeases Mr. Livesey; and while he does not accuse the mass of the Institute of having had part in it, he does assert that there were "prime movers" in the matter. When he whittled the expression down to "prime mover," a ripple of amusement passed over the audience. He thinks it must have been very distasteful to Mr. West and Mr. Hepworth to have been introduced, as they were at the last meeting of the Institute, as obstacles to amalgamation. The mention of their names led Mr. Livesey to ask, "Why should we not give some honorary position to men who have served the industry with distinction?" His suggestion is that a new Society might elect all Past-Presidents as honorary members; and in this class could be included any men of eminence who have rendered service to the gas industry, whether traders or not—in fact, any man whom the Council saw fit to recommend and the members to approve. This last remark clearly shows that even yet Mr. Livesey does not despair of eventually seeing the profession re-united.

There was little deviation in the subsequent discussion from the line taken by Mr. Livesey. Speeches in support of the resolution were made by Mr. William King and Mr. F. W. Cross; the former of whom seconded the resolution, and both expressed their disappointment at the result of the negotiations. There was a little conversation, initiated by Mr. R. O. Paterson, as to whether the resolution does not really shut the door to further negotiation; but it was made abundantly clear that it refers merely to the letter of Feb. 26, and has not the effect feared by Mr. Paterson. The willingness of the Institution to continue the negotiations on the original lines was also emphatically declared. Mr. Robert Morton and Mr. Charles Meiklejohn were followed by a stirring little speech from Mr. S. Y. Shoubridge, who, as a member of both the Institute and the Institution, is distressed that the Council of the Institute should have thought fit to address such a letter as that of Feb. 26 to the Institution. He agreed that it was an insult, and said he should be much surprised if the members of the Institute supported their Council in the matter. On this point, Mr. W. Doig Gibb mentioned that, at the meeting of the North of England Association on the previous Saturday, he had talked with individual members of the Institute on the subject; and he did not think they would support the letter. Certain suggestions emanated from Mr. Fletcher Stevenson and Mr. T. Berridge; and then Mr. C. E. Botley placed the onus of responsibility for continuing the negotiations upon the Gas Institute. Mr. S. Meunier and Mr. J. Ferguson Bell took a similar line to Mr. Paterson; while Mr. E. A. Harman and Mr. T. Banbury Ball gave their hearty support to the resolution, which on being put to the vote was carried unanimously. Here the negotiations therefore end until such time—if ever it arrives—as the Council of the Gas Institute may see fit to re-open the question on the old basis. Twice there has been a breakdown on the side of the Gas Institute—First, at the last annual meeting; and, secondly, by this departure by the Council from the principles in which the members themselves have acquiesced for the greater part of the time during which the negotiations have been pending. May a third effort carry through the desire of the vast majority of the gas profession. After Mr. Livesey's suggestion, the final issue rests with the Institute.

[The decision of the members was formally communicated to the Secretary of the Institute, Mr. W. T. Dunn, after the meeting; and last Saturday the Council of that body had it under consideration. A further communication was afterwards addressed to the Council of the Institution; and a copy was yesterday forwarded to us for publication. It is given in our General Report at the close of the discussion on the amalgamation question. It will be seen that in the most important particular the Council of the Institute do not revert to the former basis of negotiation. On the questions of dissolution and the name of the new society, they are willing to give way; but they desire to maintain their stand as to the admission *en bloc* of all and sundry connected with the Institute.]

The Technical Work.

There was a reduced attendance after the midday adjournment, when commencement was made with the technical section of the programme. There were only five papers, which (even if one or two fell short of the high standard expected of Institution work) were all fruitful of discussion; and they fully occupied the time at disposal in the two days' sittings. But if readers detect deficiencies in any of them, they will look upon them indulgently when they know that the Institution, like other Gas Associations, has felt the dearth there appears to be in the country of gas matter suitable for contributions to our technical associations. In fact, it is no secret that the President had to importune the members (as

Presidents of other Gas Associations have recently had to do) to supply material for debate. Hence some of the papers were prepared hurriedly; and their shortcomings, if any are noticed, must in part be attributed to this.

Mr. Thomas Holgate was the first contributor to claim attention; and he presented a paper entitled—

Notes on Water-Gas Manufacture.

The compilation of this communication must have involved a great deal of labour and inquiry. It took a broad range of the subject, and figures (results of experiment and analyses) bulked largely in it. Hence it is somewhat a troublesome task to give a condensation which shall adequately represent the facts and features. A considerable part of the paper was taken up by a comparison of water-gas manufacture under diverse conditions. Mentioning that the continuance of high-priced oils has brought into prominence the secondary advantages of carburetted water gas, the author alludes to the desirability of not allowing those secondary advantages to obscure the main issue—viz., the obtaining of the most suitable gas at the lowest cost. He gives a large amount of information regarding the Dellwik system, the distinctive features of which are now fairly well known. In tabular statements he shows that Mr. Dellwik's estimate of working expenses is 3·3d. per 1000 cubic feet; while his (the author's) is 6d., including boiler fuel and repairs, salaries, &c. Mr. Dellwik estimates the cost of a mixture of 4 of coal gas to 1 of benzolized water gas at 10·86d.; while the author's estimate is 11·7d. In the items composing these figures, the cost of purification of the blue water gas (lime and wages) is entered at 0·25d. in Mr. Dellwik's estimate, as compared with the author's estimate of 1·25d. Mr. Holgate thinks the latter will be nearer the cost where lime is used to remove 3 to 4 per cent. of carbonic acid. The percentage of carbonic oxide in the mixed gas, benzolized or otherwise, would, according to the author, be greater than with mixed coal gas and carburetted water gas. The calorific power of the mixture is less than when carburetted water gas is used; but while this would be advantageous in an incandescent burner, it would be a disadvantage in heating and motive power. If, however, the benzolizing is omitted, then the reduced cost would fully compensate for the reduced heating power.

Tests made on the Halifax carburetted water-gas generator to determine in what way the results are affected by reducing the depth of fuel, reveal that, taking the carbonic acid only produced with a depth of 5 ft. 9 in. of fuel, at 1, 3, 5, and 6½ minutes, the figures were 0·42, 1·6, 2·4, 6·2; and the average 2·65. With a depth of 4 ft. 1 in. of fuel, the figures for the corresponding minutes were 2·8, 3·4, 6·2, and 9·4; and the average 5·45. The claims put forward as to the value of superheated steam are discussed by the author; and the advantages to be gained by pre-heating the air are dealt with. The general effect upon the process would be to diminish the length of time occupied in blowing, and to increase the periods of running with a higher speed of steam through the generator, while maintaining the desired percentage of carbonic acid in the water gas. As steam under pressure is not required, there is no reason why exhaust steam should not be superheated; and thus largely reduce the labour and fuel at the boilers. No matter whether the Dellwik or the Lowe type of generator is used, marked economy, the author contends, will accrue by saving the heat in the way he describes. At Halifax, the boilers are fitted with Musgrave's superheaters; and the steam for the various engines and the water-gas plant is therefore delivered dry, and at a temperature of about 480° Fahr. The result of this has been to extend the runs from 5 to 6½ minutes, coupled with a low percentage of carbonic acid in the gas.

The author discusses the figures given by Mr. Glasgow at the Paris Congress last year; and he comes to the conclusion that the figures as to the heat utilized show that a considerable margin exists for further improvement. A passing criticism is made of the somewhat indefinite manner in which the capacity of water-gas plants is rated; and then he points to the use of hot coke in the plant being advantageous, as practised at Halifax. He also asked for experiences as to the use of water-cooled and non water-cooled valves. Among other points, he alludes, in connection with the carburettor, to the method of spraying or atomizing of the oil (as devised by Mr. Botley) as being a step in the right direction, and commends Messrs. Cutler's system of raising and lowering the oil-sprayer. He also refers to Mr. T. G. Marsh's continuous test for carbonic acid in the crude gas. The author remarks upon the necessity of consumers being furnished with a suitable burner at a moderate cost, where a mixture containing water gas is supplied; and he mentions that the Halifax Corporation have decided to supply at cost price the best governor burner suited to the small consumer.

In the discussion, it was gathered that Mr. S. Y. Shoubridge, from an experience of two years, regards water-cooled valves as altogether unsatisfactory. Mr. C. F. Botley drew some interesting conclusions from the figures given by the author; and his remarks will be found fully reported elsewhere. He thinks Mr. Holgate must sacrifice some heat in his carburettor and superheater; and speaking of the fuel in the generator, he believes that every set of water-gas plant has its characteristic—in the generator more particularly. At Hastings the quantity of fuel used compares unfavourably with Mr. Holgate's figures. Mr. Botley has experienced little trouble with the ordinary up-and-down valves. For a water-tube boiler lately installed at Hastings, fuel left from the generator is used with very great advantage. Mr. Botley also confesses that the atomizer referred to by the author is not satisfactory with all kinds of oil; but with ordinary oil it is so. He speaks well of Bray's slit-unions for ordinary illumination with a mixture of coal and water gas. One of the main points in some remarks by Mr. J. W. Helps is that while one is aiming, with water gas plant, at perfection in one direction, losses may be sustained in another. Mr. Holgate's results seem to prove that something of the sort is happening at Halifax. As to superheated steam, he has always thought this was a step in the right direction. The interesting figures given by Mr. Holgate as to the effect of reducing the bed of fuel show that, if it is brought too low, the rise of carbonic acid is excessive. At Stockport, Mr. Meunier states, on the average the candles per gallon of oil per 1000 cubic feet is something over 7; the consumption of coke works out at little under 35 lbs.; but the consumption in the boilers is close in the neighbourhood of 10 lbs. Difficulties he has noticed have been mainly in the spraying of oil. He has never obtained satisfactory explanations as to the variations in the results obtained with water gas plant; and he thinks to a large extent they must be due to the human element. The main factor in the cost of carburetted water gas is the proper working of the oil, and getting the best results from its gasification. The manufacture of carburetted water gas at Stockport has helped Mr. Meunier to get a higher price for coke. Mr. J. S. Ashworth states that at Portsmouth he gets 7·2 candles per gallon of oil used in Messrs. Humphreys and Glasgow's plant; the coke consumption is approximately 36 lbs. per 1000 cubic feet; and the carbonic acid is very variable—ranging from 3 to 5 per cent. It is clear from the remarks by Mr. D. H. Helps that, on the figures given by the author, he does not consider the results of the Dellwik plant are any better than those obtained under the Lowe process. On the other hand, Mr. Dellwik does not think the plant on his system from which the figures were given was working in the way it should do, seeing that the carbonic acid should be higher than 11 per cent. With one of his plants as much as 17 and 18 per cent. has been found. He holds that analyses of the gas should be made of the whole of the gas in the holder, and not at minute intervals during the run, as during the latter part the production is smaller. He states that at the present time benzol is much cheaper than oil for carburetting. Mr. J. T. Westcott caused a little amusement by saying that every set of carburetted water-gas apparatus seems to have its own personal equation, and varies just the same as one person varies from another. The efficiency alters greatly according to the size. It gradually increases up to 750,000 or a million cubic feet; above that point it gradually runs down. The President does not think there are any mechanical difficulties in the way of ensuring a uniform thickness of the fuel bed. In his reply, Mr. Holgate made it clear that the tests on varying depths of fuel beds were for the purpose of finding out what would be the effect of shallow beds. The usual working level is, of course, much higher.

Purification, and Methods of Working.

The author of the next paper was Mr. B. W. Smith, who had during the day been keeping a watchful official eye over the interests of the gas undertaking of the Walsall Corporation before the Parliamentary Committee on the Mond Gas Bill. It was only after the rising of that Committee that he could attend the meeting to read his paper; and to enable him to do so, the sitting was considerably prolonged

beyond the usual hour. But by the time he commenced the paper, the number of members had been sadly thinned.

Mr. Smith did not attempt to cover the whole process of purification; and his communication must simply be taken as a statement of his views, moulded from a long and extensive experience, on some salient and debatable points in this fascinating part of the operations of a gas-works. But while Mr. Smith's conceptions of what is the correct thing in gas purification are welcome, the enumeration he has made (at, it is patent, some expense and a great deal of personal trouble) of the practice in regard to the materials used in the purifiers at no less than 1264 works, has an interest which will individualize this contribution to the subject. With Mr. Smith we can only regret that his self-imposed task did not meet with the full encouragement it deserved. Preceding the main part of the paper came two or three definite statements, which, discased of the surrounding matter, may be given shortly: From the hydraulic main to the condenser, the gas should be relieved of its heavy tar and other liquids, as it is more easily cooled when the hot tar is removed. Then, while the gases should gradually cool down in the condensers, the temperature at the outlet should average about 60° Fahr. On the question of scrubbing and washing, the author favoured the use of the Livesey type of washer, and the bringing of the gases, in a state of minute subdivision, into contact with a constant stream of strong liquor. As to the purifiers, while the old form of water-luted boxes still seems to be the favourite, the author admits the growth of the adoption of Green's system. At Walsall, for example, he himself, influenced by the accommodation at command, is about to put down four pairs of boxes, 48 feet by 18 feet by 6 feet deep.

On taking charge of the Walsall works, the author found in one section of the purifying plant that oxide was used first and lime afterwards; and in the second section, the order was reversed. This suggested the circularizing of the gas-works of Great Britain, for the purpose of finding out the prevalent practice. Here is the result: In 998 gas-works in England and Wales, 546 use lime only; 81 use oxide only; 371 use oxide and lime in conjunction. Of the 371 using the two materials, 199 use oxide first, and then lime; 85 use lime first, and then oxide; 87 use them alternately in layers or in both positions. In 184 works in Scotland, 169 use lime only; none use oxide only; 5 use oxide first, and then lime; 10 use them alternately. In 82 works in Ireland, 65 use lime only; 5 use oxide only; 5 use lime first, and then oxide; 4 use oxide, and then lime; and 3 use them alternately. The total is 1264 works, of which 780 use lime only, 86 oxide only, 90 lime and then oxide, 208 oxide and then lime, and 100 use the material alternately, or sandwiched in the same box. A passing reference is made to Weldon Mud; but, while the author refrains from the expression of any decided opinion, his remarks lead one to suppose that its use does not commend itself to him. In the majority of the works using lime only, the sulphur clauses do not apply; but where works are under these clauses, lime purification is, in the author's view, somewhat of an elaborate, delicate, and costly process. Where oxide and lime are used, he has a preference for their employment in the order here mentioned; but he raises, and gives his reasons for, objections to the use of the two materials in layers in the same purifier. In his arguments in favour of the separate system, he instances a works where, on layering being abolished, and lime being used only as a final catch, the percentage of prussian blue in the oxide rose from 1·30 to 8·1 per cent.; so that the spent oxide is now a valuable source of revenue.

It will be found that a feature of the paper is a list of analyses of various samples of oxide that the author has had submitted to him. He points out that the purifying value of an oxide depends more on the state of hydration than on the high percentage of oxide of iron; and, in proof, he gives the results of experiments. The analyses of two samples of lime are recorded; followed by analyses of the spent lime after and before oxide, from which it will be seen how far it is possible to work up the lime to its fullest extent as a carbonator. Then another set of analyses reveals the effect on oxide of proper and improper condensation, washing, and scrubbing. The figures in the latter case show that the oxide is made to do the work of the scrubbers and washers as well as the purification, and, in addition, it is spoilt by tar and naphthalene; so that, although it only contains 25 per cent. of sulphur, it is practically spent. The considerable influence of the size of the vessels on the cost of purification and the duty power of the material is a strong point with the author, who has found from experience that it is better to have an excess of area than too little. The figure he adopts is about 430 square feet per million cubic feet of gas. Mention is made of the economy of having a sufficient number of boxes, inasmuch as a foul box will do a considerable amount of purification long after it has commenced to pass some of the impurity which it is intended to arrest. Useful hints are given on the slaking of lime and on the revivifying area for oxide. The paper, with its analytical proofs of the author's views, may convince some gas engineers of the errors of their purification ways; and it should be particularly helpful to the managers of small works.

The discussion could not be completed at Wednesday's sitting; it being one upon which quite a number of the members had something to say. Mr. J. S. Ashworth opened the debate. He believes in removing the tar from the gas as quickly as possible. The cost of purification in his case is the low one of ½d. per 1000 cubic feet. Although situated near the place of its production, he has to pay 19s. per ton for lime. In connection with his water-gas plant, he purifies with oxide of iron; and to prevent it being spoilt by the oil, he has a tray of breeze put all over the bottom tier of the purifiers. His view is that purifiers cannot be too large if it is desired to get out impurities in valuable form. At the East Greenwich works, according to information given by Mr. C. C. Carpenter, the last constructed section of purifiers for 6 million cubic feet has been laid out by adding to the boxes for working lime in rotation another box containing oxide of iron. The oxide is put in in four layers, and each layer is provided with a Cripps valve, so that, if one layer becomes blocked up, the tier can be bye-passed. He disagrees that purifiers may be of any size; and he points out that, if they are too large for the work to be performed, the full work is not got out of the purifying material—large patches of virgin material frequently being found. It seems to him that the plant should be of such a size that it can be readily regulated between the summer and winter requirements. Mr. H. Iago, having to increase his purifying area, in order to do it cheaply, enlarged the boxes; and he has found the patches mentioned by Mr. Carpenter. With too large an area of purifiers, he says the sulphur becomes unmanageable. His cost for purification is about 1d. per 1000 cubic feet. Mr. T. Glover remarked upon several points not brought out in the foregoing abstract of the paper; but they will all be found in the full report. He has noticed that purification is often very efficiently carried out where it is done in a haphazard manner. Following an observation or two from Mr. G. S. Sayner came Mr. S. Glover, who puts in a plea for complete purification. His experience at St. Helens has been with lime only. The size of his boxes (four in each set) is equal to 500 square feet per million cubic feet per box per day. By the thorough mixing of the lime, by careful purification, and by properly putting the material into the boxes, very efficient results indeed are obtained. He generally produces his gas with not more than from 7 to 9 grains of sulphur per 100 cubic feet in it; and he seldom gets more than 1 grain of ammonia per 100 cubic feet. The boxes are worked four in each set, excepting when changing one. The boxes are not changed until the third one begins to show a trace of sulphuretted hydrogen passing. The cost is less than ½d. per 1000 cubic feet. He has no catch boxes after the lime; and he tests on the third box.

The discussion was re-opened the following morning by the President. To him there seems to be a considerable difference of feeling among engineers as to the cost of Green's system of constructing purifiers; and he says that he came to the conclusion that, in the long run, he should lose money by adopting it. With Green's system, the advantage of that effective safety-valve which the water-lute purifiers provide is lost. He regards as a very important point that brought out by Mr. Carpenter as to the limitation of the size of the purifiers, in order that the differences in make may be dealt with. The variations in success of purification is due, in Mr. J. W. Helps's experience, to two causes—from changes that take place in the quality of the gas made, and from changes in the quality of the purifying material. Whenever he gets trouble with his purifiers, the first thing he does is to go and look into the retort-house. At Croydon, four boxes of lime are worked in rotation, and then there is an oxide catch box; and just lately a large catch box has been put down in which Weldon Mud is used. Mr. Helps cannot speak too highly of the use of Weldon Mud in the final catch boxes. With anything above 10 per cent. of moisture in the oxide, he asserts, the

purification suffers; and it is important that lime should be slaked as long as possible before use. Mr. George Livesey describes the test imposed for sulphuretted hydrogen in London as a "brutal" one; and Mr. D. H. Helps states that he cannot see that the area of the purifiers matters at all, provided there is sufficient gas passing per superficial foot of purifier. In order to get the necessary capacity for purification, Mr. Holgate has constructed purifiers on Green's system, 57 feet in width by 38 feet by 10 feet in depth. Each box is fitted with six covers. By $\frac{3}{8}$-inch rubber, he has been able to get a perfectly tight joint; but he appears to have a preference for a luting of special section, which he illustrated on the blackboard. The cost of construction, in his experience, is much less than on the ordinary system. Touching on the point that purifiers may be too large in area, Mr. A. F. Browne is not convinced that, from a chemical point of view, they cannot be too small. A real difficulty of small boxes is the blowing of the water-lutes; and he is surprised at the President's remark as to water-lutes being desirable from the point of view of a safety-valve. As to the use of air in lime purification, he finds the place to introduce it is in the box into which sulphuretted hydrogen is freely entering and sulphide being formed. He advocates the placing of lime purifiers in covered buildings. A little short of 20 per cent. of moisture in oxide does not, in his view, affect the chemical action. Mr. W. J. A. Butterfield, on the delicacy of the sulphuretted hydrogen test, mentioned an action in which he was concerned referring to an alleged nuisance from a gas-works. He found a distinct discoloration of lead paper with one volume of sulphuretted hydrogen in twelve million volumes of air, and a distinct stain with one volume in a million volumes of air. The lead paper was exposed for from 12 to 16 hours. This experience created no little amusement. The author was desired by Mr. E. A. Harman to say the temperature which he finds most desirable for the revivification of oxide of iron. In his reply, Mr. Smith emphasizes the importance of placing purifiers under cover. The structural arrangement of his purifying-house is one reason why he adopted Green's system; but another ground for his choice is that, the cost of labour being a serious matter, he has adopted machinery for discharging the purifiers. Lime, he says, should never be allowed to be used directly it is slaked. The moisture in oxide is also a very important point. As the oxide becomes spent, it is a very easy matter to withdraw the water, and enhance the value of the material by selling it with much less moisture. He agrees that variation in the results of purification hinges upon the quality of the gas. In the Midlands, he uses eight or nine different sorts of coal; and it is impossible for him to draw a fine line as to the class of purification requisite for each kind of coal. Ample, but not extreme, purification appears to be Mr. Smith's motto. Having the boxes subdivided, he thinks, would be a costly process for some managers. It is, in his opinion, better to revivify oxide in the open than under cover, except in snowy weather.

Differences between British and Continental Gas Engineering.

Mr. C. E. Brackenbury next succeeded to a hearing with his paper on the above subject. His past Continental experience, and his present environment—resident in England, but in daily touch with Continental gas practice—enables him to speak on the topic with a more than superficial knowledge. The contribution was indited with a lightness and freedom which made it, the deeper he read, increasingly attractive, for the more he said, the more the British spirit of his auditors became perturbed, and when he finished, with all good humour, several gave vent to their objections. But on taking a review of the discussion, the speakers, it appears to us, did not take to themselves sufficient credit from the portions of the paper in which the author made complimentary references to the premier position held by British gas engineers in connection with the larger structures of a gas-works, but they allowed the lighter shafts to sting.

Turning to the paper, the author, in the first place, is struck by the fundamental difference between the training of the *personnel* of Continental and English gas-works. The former consists in part of men who have graduated in recognized public engineering schools; while with the latter, the early training is more haphazard, and less systematic, scientific, and thorough. Due partly, no doubt, to his better technical education, the scientific status and social standing of the Continental gas engineer are far above those of his English colleague. To the higher technical training of both chiefs and assistants Mr. Brackenbury attributes the fact that modern gas-works abroad show a somewhat more studied understanding of the problems to be solved, a rather more careful calculation of ways and means, and a little more exact proportioning of plant. English works nevertheless still excel in directness of purpose, simplicity of apparatus, and thoroughness of workmanship. By grafting on to our British methods, however, something of the spirit of the Continental engineer, the future of the gas profession at home will be made more secure and bright. Light and leading, Mr. Brackenbury says, may also be seen over the water in the more artistic treatment of gas-works than is to be found here. He urges that it is better to build, for example, a retort-house both beautiful and practical than one that is the latter only. The utility of an article is no excuse for its ugliness. He refers to the fine façade of the retort-house and other buildings of the new gas-works at Vienna, and follows this up with a scathing remark about the "grossly utilitarian and hideous" houses on English gas-works. English gas workers will be glad to know that their conditions are of a superior order to those of their brethren on the Continent. There labour is obtained at a lower cost; and the hours of labour are longer—the usual shifts being twelve hours; and the author knows of a case where the stokers prefer to work 24 hours on alternate days!

Passing to questions more particularly appertaining to the works, the author states that, while mechanical means of handling coal and coke are rather more general in England, more perfect and complete installations (at least with regard to coal) are to be found on the Continent. The regenerative furnace is more commonly adopted abroad than it is as yet among us; and double recuperation is the more favoured system. Higher heats are also the rule; and slightly larger or more frequent charges are adopted. Outside producers are, on the whole, more general; but there are indications that inside producers are gaining in favour. Continental settings are often single; and where back to back, the retorts are almost invariably ended ones. Inability of the stokers to manage them, and the liability of the ascension-pipes to become stopped up, are among the objections to through retorts. Characteristics of Continental retorts are that they are wider and shallower in cross section, with a length of about 10 feet. The author has proved them to be good carbonizers. Nine is a favourite number in a bed. Inclined retorts have not been adopted so largely on the Continent as in England. Practically, however, the whole of the Continental installations have been carried out by one firm, owing to patent laws and rights. But some of these have recently expired, and others are about to; so that we may look forward to the various personalties of Continental engineers soon being given full expression for the first time in this direction. The length of inclined retorts is striking. As one instance, at Zurich, they are less than 11 ft. 6 in. long, and in some other cases about 15 feet long. It is in the author's knowledge that the probability exists of 20-feet retorts being adopted in two Continental countries for future installations. Other features of the retort-settings is the greater span given to arches, and the greater strength of the piers, than in England. Regarding the charging of the retorts, the storage tanks are not often continuous on the Continent; but the author regards the English practice of continuous hoppers, &c., as the only sound and secure system. Not much has been done on the Continent in regard to stoking machinery; and the author accords in the fullest measure praise to the British inventors for the results of their labours in this direction.

The Continental tendency is now towards abolishing high apparatus in favour of equally efficient but low apparatus—such as the supplanting of vertical condensers and tower scrubbers by horizontal ones and mechanical washers. Electricity is adopted in Continental gas-works for a variety of purposes; and the author appears to favour its use, although he does not expressly say so, as an auxiliary. The small dimensions of the purifying-boxes on the Continent are mentioned as a noticeable feature; but the purification requirements are not nearly so onerous abroad as at home. The average smallness of gasholders is also remarkable; and in this department, the author observes, English makers have led and taught the world. But in this, as in other branches of manufacture and commerce, their supremacy is threatened. The low illuminating power (speaking generally) of Continental gas, renders the use of enriching plant unnecessary. As to residuals, the author remarks

upon the greater number of small works on the Continent that manufacture sulphate of ammonia, and upon the fact that the recovery of cyanogen is more largely practised. Properly fitted and used laboratories are not quite so rare in Continental works as they unfortunately are in England. Comparisons are made as to the conditions of gas workers at home and abroad; and public lighting is contrasted, in which department—North London having the distinction of special mention—we do not excel. However, prepayment meters were far later in being introduced on the Continent, and are still suffering from initiatory difficulties.

The President's remarks, in opening the discussion, shows that he sides with the author to a large extent. While there are parts in the paper which may be distasteful to English engineers, he says there is also a great deal of truth. He agrees that many of our works are far more hideous than they need be. A point that has struck the President is the amount of skilled departmental supervision met with in most Continental gas-works. In English works, there are not, he holds, a sufficient number of responsible men at the call of the engineer at the present time; but he thinks that this is simply because the posts have not been made for them to occupy. The remarks of the author as to the training of English engineers are endorsed by Mr. Ashworth, but not those referring to the artistic treatment of gas-works, on account of the unnecessary expenditure of capital. He agrees with the system of outside producers so long as they are outside the retort-house; and he recognizes advantages in single retorts with machine stoking. But as to using electric lighting in gas works, he likens it unto "taking bread out of your own mouth." Mr. J. L. Chapman coincided with the author to the extent that gas-works buildings should be constructed in the most tasteful way possible for the money which the proprietors could afford to lay out upon them. As to inclined retorts, Mr. Chapman has plans ready for an installation at Harrow; and, in connection with it, he asked for views as to using continuous hoppers. Very caustic in his remarks was Mr. E. A. Harman. The question of artistic merit, he says, is only one of cost; and he deprecates most strongly the extravagance of some of the gas-works on the Continent. As to electric lighting on gas-works, he says no gas engineer has the slightest objection to it [he forgot Mr. Ashworth] excepting on the score of cost. Among other points, Mr. Harman credits the past methods of the Welsbach Company with having been the means of preventing as extensive an adoption of incandescent gas lighting as is now to be found on the Continent. That Mr. Brackenbury went out of his way somewhat to make his comparisons is the opinion of Mr. R. Brown. Ornamentation is all very well in a way; but where, asks Mr. Brown, are dividends to be got from? Regarding Mr. Chapman's question, he has not the slightest doubt that continuous hoppers are preferable. Mr. William King's opinion as to ornamentation of gas-works confirms that of previous speakers. Some Continental gas-works he describes as magnificent; but he thinks the duty of constructive gas engineers is to produce sound and substantial buildings at the lowest possible cost. Between Continental and British gas practice, he admits that, in many details, the former presents advantages over our own; but in apparatus and in the essential parts of the manufacture of gas, we come out of the comparison exceedingly well. Mr. A. F. Browne, referring to outside producers, calls to mind the work of Mr. Frank Livesey, and mentions that he believes Mr. Carpenter is still at work in the same direction. In his opinion, the outside producer has much to commend it. It simplifies the work of the retort-house; it removes a source of danger to the men; and it lengthens the life of the producer itself. Mr. Henry Hawkins has found advantages in taking his gas off both ends of his inclined retorts—one of them being an increase in the production, of 400 to 500 cubic feet of gas per ton of coal carbonized. His retorts are 20 feet in length by 22 in. by 15 in., and tapered. The President also favours continuous hoppers; but he cannot see that it is necessary to have two ascension-pipes if the charges in the retorts are properly regulated. Mr. S. Simmelkjör does not think Mr. Brackenbury has visited a sufficient number of Continental works to enable him to form fair conclusions; anyway their experiences do not concur. Mr. Simmelkjör has also found that English engineers are quite up-to-date in the adoption of new methods of working. In proof of his authority, Mr. Brackenbury mentions that for ten years he has done nothing but breathe the air of Continental gas engineering, and has consequently become saturated with the drawings and plans of Continental gas-works. He recognizes the difficulty of making any survey of these differences in practice without laying oneself open to charges. In the paper submitted he says he purposely emphasized certain points so that they might be brought into prominence. As to the remarks of speakers upon the question of ornamentation, he explains that all he put in a plea for was simple effects in gas-works buildings. No one, Mr. Brackenbury observes, touched upon his point as to street lighting in this country; and so he supposes all present at the meeting are so thoroughly ashamed of it that they did not care to open their mouths about it.

The first paper at the afternoon sitting was by Mr. W. J. A. Butterfield; and it was composed of

Notes on the Conditions which Prevail within a Carburetted Water-Gas Plant.

In this paper there is such a coherence of parts that it is difficult without affecting the author's argument to give anything approaching an intelligent digest of it; and so we shall not attempt the task. The full text, however, will be published next week. Meanwhile, it may be said that in the first part, Mr. Butterfield deals perspicuously with the reactions involved in the production of simple or uncarburetted water gas. Then later on, in illustrating one of his points, he refers to the carburetted water-gas plant in use at the Southall works of the Brentford Gas Company, which in actual work has shown an unusally high efficiency. The installation comprises four sets, capable of producing 700,000 cubic feet of carburetted water gas per diem. The works' returns show that, during the second half of 1900, the coke consumed in the generator averaged 37 lbs., and the oil 2·89 gallons per 1000 cubic feet of gas made. The illuminating power of the gas at the time the author made his tests was 19·70 candles. The gas was burnt in the London argand burner at the fixed rate of 5 cubic feet per hour, without purification for the removal of carbonic acid (the percentage of which, however, was only about 1·7). The gas might, therefore, be considered as equal, after purification, to fully 21 candles in illuminating power. The set from which the samples were drawn was being worked by the usual operator, under normal conditions throughout. Following this statement the author gives much information as to some analyses recently made by him of the gases formed within the plant; and from his deductions there appears to be no question that from 20 to 25 per cent. of the heating value of the fuel consumed during the blows in carburetted water-gas plants is at present needlessly wasted.

The suggestions which the author gives for improving the present results of the working of plants are best taken from his own summary, as follows: (1) The steam supplied during the run should be gradually reduced as the run advances. Whenever the gas produced, if blown off from a cock on the generator-lid, visibly contains steam, it is an indication that more steam is being admitted than the carbon of the fuel-bed can deal with; and it may be taken for granted that the secondary reaction is happening to an undesirable extent. (2) The run should be extended by from one to three or more minutes beyond its present duration, regard being paid throughout to the first suggestion. (3) Air should be supplied more liberally to the generator during the blows, so that in a set designed to make half-a-million cubic feet or upwards of 20-candle power gas per diem, the products of the blow at the top of the generator should contain about 13 per cent. of carbonic acid. (4) The working of the generator should be controlled by testings at regular intervals of the percentage of carbonic acid in the products at the top of the generator during both the run and the blow. It seems to the author that, if these suggestions were carried out, the productive power of a given plant would be considerably increased, while a saving of from 3 to 6 lbs. of fuel per 1000 cubic feet of gas made would ensue.

The discussion on the paper was not so extensive as it merited; but the fact that there had been a contribution on a cognate subject the previous day, and the small attendance of members at this period of the meeting, are sufficient explanations. The suggestions of the author for improving the working of a water-gas plant, are, in the judgment of the President, most sound and satisfactory; but whether gas manufacturers can afford to have skilled assistants in charge of the plant for the purpose of attending to the necessary regulation of the valves, or whether they can be made to regulate themselves, is a question. The value of the paper is also acknowledged by Mr. F. W. Cross. He states that it clears up in his mind many points that he has observed in

his own practical working; and he thinks gas engineers owe to Mr. Butterfield a debt of gratitude. The diminution of the steam during a run, he agrees, must have considerable effect upon the amount of carbonic acid produced; and this is what water-gas makers are aiming for—the keeping down of the carbonic acid. That considerable improvement is possible in water-gas plants is fully concurred in by Mr. T. Holgate. There is, he says, nothing inconsistent in what Mr. Butterfield states as to the slowing-down of the velocity of the steam during a run. It would be possible to superheat the steam and diminish the rate of flow towards the end of the run. The tendency may be in the future to decrease the amount of oil used in making carburetted water gas, and produce a gas of lower illuminating power. If this is so, it becomes still more necessary to make the generator as efficient as possible. In connection with the small amount of carbonic acid found in the plant at Southall, Mr. D. H. Helps put a question as to the nominal capacity of the plant as given by the makers, and what was the capacity of the plant at the time the test was made. To this he added the remark that it is quite easy to keep down the carbonic acid provided one also keeps down the quantity of gas made. The information given by Mr. Butterfield will, Mr. J. W. Helps believes, be of great use. The paper, he says, is an able defence of the Lowe plant as compared with the Dellwik. As to the question of carbonic acid, it resolves itself into one of £ s. d. Roughly working out the actual result from a gallon of oil in the Southall plant, and taking the illuminating power of the gas at 21 candles, he finds it comes to 7·2 candles per gallon. At Croydon better results than this are obtained, notwithstanding the carbonic acid averages 3 to 3½ per cent. Although one may be working in such a way as to reduce the carbonic acid to the lowest limit, yet, remarks Mr. Helps, the final result (which is the main thing to look at) is none the better in the end. The paper, he also regards as a defence of one part of Mr. Brackenbury's communication—viz., that referring to the better training of pupils. So far it seems to Mr. Helps that water-gas plants have been worked on rule-of-thumb principles. In their operation, perfection has not been arrived at; and there is a great deal to look for and to hope for. On the point raised by the President as to the automatic regulation of the steam and air supplies, Mr. Butterfield states that the matter is already under consideration by one of the plant makers. So far, however, nothing practical has been done; but it will probably be tried in some new plant. As to the Southall plant, its nominal capacity is 600,000 cubic feet per set; but it has actually made 700,000 cubic feet. He could not give the make of gas for the day on which he took the samples; but no one, he states, was aware that he was going down to take them. Mr. Butterfield is of opinion that many water-gas plants are being worked improperly; and that in many instances oil is being wasted.

The Progressive Age.

The last paper on the programme was by Mr. J. D. Ashworth; and it bore the above title. The fitness of the title is a little doubtful—at all events, in its application to the first part of the paper, which appears a little too pessimistic in tone to give one the impression of progression so far as the gas industry is concerned. Many undertakings have fallen, according to the author, into a somewhat stagnant state—there are, he admits, some where the growth of business continues; there are others which indicate a downward grade. He admits that the unpropitious conditions prevailing last year no doubt accounts for a great deal of the falling off. The author suggests that much of the sluggish condition of affairs which now exist could be overcome if the industry were to more seriously consider their position, and adopt a more stringent method of overcoming the "difficulty." As business men, it is no use, remarks Mr. Ashworth, for gas engineers to close their eyes to the fact that electricity is making rapid strides—not only for lighting but for motive power. Electrical motors are being largely used, and are making good progress as compared with the smaller size gas-engines. He refers to the threatened advent of Mond gas as a competitor; and he expresses the fear that gas managers have accepted their rivals in too friendly a way, and have allowed customers to dwindle away, one by one, without offering sufficient resistance. In the author's opinion, the time has arrived when a scheme should be considered by the industry for universally following the principle adopted by our German friends, in the establishment of a low-grade standard gas—say, of 10-candle power. He has no hesitation in saying that a low-quality gas such as this could be produced and sold at 25 to 30 per cent. below the price now charged for 15-candle power gas, and would give the undertakings profitable remuneration. The advantages of such a supply from the makers', the consumer's, and the industrial points of view are all considered.

In the discussion, comments were made upon the electric light competition by Mr. J. Ferguson Bell; and he suggests that unfair competition should be met by the gas companies charging differential prices for gas. He disagrees with Mr. Ashworth as to dropping down to a 10-candle power gas. As Mr. W. Doig Gibb states, it must be accepted as a fact that electricity has come and has come to stay in certain places. A cheering statement is supplied by him. In Newcastle, there are two Electric Light Companies, and the percentage increase in gas consumption was lower in the ten years previous to their advent than it has been during the past ten years, during which the Gas Company have been subjected to their rivalry—the gas consumption, in fact, has increased more than double. Motive power supplies, Mr. Gibb regards as a very serious aspect in the competition of electricity. He believes that he has the largest single consumer of coal gas in the world; the consumption in this one case being 300 million cubic feet. One of the high officials connected with the Company he refers to recently told him that there was no such cheap power as Newcastle gas at the present moment. The price is now 1s. 9½d. net.; and this consumer, Mr. Gibb says, obtains no benefit over a consumer burning (say) 400,000 cubic feet. He cannot advocate the supply of a gas of so low a quality as 10 candles; but he does think that the natural gas to supply is the best that can be produced, without resort to artificial enrichment, from the available coal. Mr. F. W. Cross joined issue with the author as to the stagnant condition of the gas industry. Mr. Chapman states that at Harrow, previous to the introduction of the electric light, the increase in gas consumption was something like 2½ per cent.; and since its advent the increase has been about 8 per cent. In his reply, Mr. Ashworth did not in any way recede from the statements contained in his paper.

General Matters.

On the invitation of the President it was agreed that the autumn meeting should be held in Edinburgh on Sept. 2—the Monday preceding the Glasgow Engineering Congress. The new gas-works at Granton will then be in an interesting stage, and, given fine weather, a very interesting day will be spent on the works. As Honorary Secretary of the Gas Section of the Engineering Congress, Mr. J. W. Helps made brief announcement regarding the arrangements that it will be necessary to make in connection with the members' visit to Glasgow. This was followed by the passing of several votes of thanks, which brought the sittings to an end.

The annual dinner was held on Wednesday evening at the Queen's Hotel, Leicester Square; and on Friday a visit was paid to the Admiralty Harbour Works, at Dover. The company numbered about 40; and, the weather being favourable, the trip and inspection were immensely enjoyed.

GENERAL REPORT.

The Annual Meeting of the Institution was held last Wednesday and Thursday, in the Hall of the Institution of Civil Engineers, Great George Street, Westminster.

Mr. J. W. Helps (Croydon), the retiring President, occupied the chair at the commencement of the proceedings.

Annual Report and Accounts.

The Chairman, in opening the business, said the annual report of the Council (*ante*, p. 1054) and the statement of accounts had been circulated among the members, and therefore he proposed that they should be taken as read. He accordingly moved their adoption.

The motion was carried unanimously.

Additions to the Roll.

The Scrutineers reported that the following new members and associates had been unanimously elected:—

Members.

Masterton, Alexander, Gas-Works, Edinburgh.
Watson, T., Gas-Works, Rushden.
Woodall, Harold W., Gas-Works, Bournemouth.

ASSOCIATES.

Gibson, T. S. F., Old Kent Road, S.E.
Gracie, Harry H., Pennywell, Edinburgh.
Greenaway, Reginald, Truro.

The report was adopted.

The CHAIRMAN said his last duty was a particularly pleasant one, and it was to introduce their new President. Mr. Herring had done good work in the South and in the Midlands; and he was now discharging important duties in the North. He had therefore had exceptional opportunity of becoming known personally to many of the members, as well as to all through the excellent work he had done. Mr. Herring was a young man, if he (being a young man himself) might be allowed to describe him as such; but he was a man who was determined to write his name very legibly on the pages upon which their history would be recorded. It was not for him (Mr. Helps) to make a long speech about his merits, but he was certain that when Mr. Herring occupied the same position that he now did, at the end of the year, all would have to confess that by his works they could judge him as one who had done his utmost to secure the interests and the welfare of the Institution.

Mr. W. R. HERRING, M.Inst.C.E. (Edinburgh), the new President, then took the chair.

THANKS TO THE PAST-PRESIDENT.

Mr. C. C. CARPENTER (London) said that, before the programme of the day was continued, he would like to have the privilege of proposing a vote of thanks to the retiring President. Mr. Helps was the first gentleman who had performed the dual function of President of the Institution as well as its Honorary Secretary. No man had devoted himself with greater earnestness and with greater love to the work of the Institution than he; and, as one who had intimately known him for a long time, he (Mr. Carpenter) had claimed the privilege of proposing the present vote of thanks.

Mr. H. IAGO expressed his great pleasure in seconding the motion, which was put and carried with acclamation.

Mr. HELPS thanked the members most heartily and sincerely for this mark of their approval. It was, of course, with mingled feelings that he looked back upon the year that was now passed. He took the chair at first with a certain amount of anxiety, and, of course, with considerable pride and satisfaction; and he desired, during his year of office to see considerable progress made in the Institution. Besides this, he hoped that a certain matter which had engaged their attention for some years would be finally settled, and that the time for holding separate meetings among the Associations representing their industry would no longer be needed. He regretted that this wish had not been consummated; but he looked back upon the past year with pleasure and satisfaction, inasmuch as all had done their very best for the welfare of the Institution.

PRESIDENT'S ADDRESS.

The PRESIDENT then read the following

INAUGURAL ADDRESS.

Gentlemen,—At the outset, permit me to thank you for the honour you have conferred upon me in electing me President of this Institution—an honour which I appreciate in the fullest sense of the term, and one that I will endeavour to sustain upon the high plane to which it has been brought by the distinguished roll of Past-Presidents. My gratification is, however, slightly marred by the fact that the one who was elected to the Vice-Presidency last year has found it necessary to vacate that honourable office; and I am sure I am only echoing the sentiments of the members of this Institution when I express a hope that he will see his way clear to adorn the office at a future date.

I do not think it necessary for me to recapitulate the history of the Institution, beyond incidentally remarking that it is financially sound and intellectually flourishing; though on the latter point we seem to be very chary of sharing our experiences and knowledge with the outside world, if one is to judge of its extent by the difficulty experienced in procuring papers for the annual meetings. Neither do I propose to review the past history of the gas industry, nor to draw your attention to the developments of gas-works construction, and the distinct advance that has been made in the structural engineering and the application of mechanical means to the purposes thereof. With these we are all more or less well versed, and have daily to review them for ourselves, in order that, from the experience of the past, we may found our policy for the future. I rather propose to deal with some general topics which have a more or less important bearing upon our future prosperity, and which I think are well worthy of consideration just now.

The present period may, I think, be strictly defined as an epoch. Not only is it the beginning of a new period in the ordinary numerical rotation of years, but it is also sadly epochal in the history of our country. The lamentable loss which the country has sustained through the death of its revered Ruler, the late Queen Victoria, has called forth a depth of feeling and unanimity of expression of the worth of the life's work of the one who has been taken from us, such as has never been witnessed before either in our own or in the world's history—illustrating in a most remarkable manner the influence that one good life still has upon mankind, and impressing us with the thought that example is better than precept; and a faithful endeavour to do our duty with a singleness of purpose is after all the highest ideal we can set ourselves to attain.

The Victorian Era signalized an epoch of the most marvellous mental activity in all lines of thought, such as has never before been witnessed in the history of the world, but probably more particularly so with regard to its industrial life and the distribution of the fruits of industry. It may be said to have been a truly industrial epoch within which many scientific enigmas have been elucidated and made applicable to the industrial life of the country. Much still remains to be done in the methodical application of scientific knowledge to the industrial undertakings of our country. As a nation, we cannot perhaps claim to have taken the fullest advantage of the principles which science has placed at our disposal. The technologists of the country appear to be quite alive to the necessity for this; but commercially we have not appreciated its necessity, nor have we consolidated our industrial concerns sufficiently to get that command of capital which will enable us to do so, and without which it does not seem attainable. The general tendency in commercial life at present appears to be emerging from that condition of individual ownership to one of collectivism, whereby kindred industries are being united into one financial whole, drawing the capital from the public at large, and gaining the sinews in this way that will enable it to modernize its methods and take the fullest advantage of applied art and science in the development of its processes and the perfecting and cheapening of its products.

The prospects of the gas industry are so closely allied with the prospects of the industrial life of the country, that in considering the one we must of necessity include the other. At the commencement of the period under review, the gas industry was, with but a few exceptions, of an infantile character. At the present time it may justly claim to have emerged from that character to one of full maturity; and we now find it enjoying the period of existence commonly defined as vigorous manhood. In fact, there are some of us who think it is still in its youth as regards vitality, guided by the mature experience of middle life. Whether this is so or not, we may well leave it to time to judge.

We do, however, know that the responsible technologists of the gas industry have in the past risen to every occasion that has presented itself, and surmounted every difficulty that has threatened its progress, whether in the form of competition, restriction, or otherwise; and the fact that the increase in the coal carbonized has risen from a total of 10,242,427 tons in 1890 to 14,568,180 tons in 1900, or an increase of 42 per cent. in ten years—this covering a period when the practical application of electricity to lighting purposes became commercially successful—is sufficient to prove it. Such then is the condition of the gas industry at the present time, and for which many of our members deserve a very large share of the credit; while there are others of us who have the distinction of being called upon to maintain this position, and to improve it if we can.

There is an undoubted sensation present in many of our minds that we are closing an epoch in the history of the gas industry. We realize that the consumers' necessities of the present day are not being adequately met by our present system of supplying a gas comparatively rich in illuminants—enriched beyond the natural value of the coal from which it is generated, by adding expensive illuminants at a cost altogether out of proportion to the advantages to be gained at the burner-tip. We feel that it is detrimental to the consumers' interests for the photometer to be the standard by which the gas supply is gauged, knowing that the calorific value of the gas is of much superior importance to the gas

consumer. The necessity to continue supplying an illuminating gas has ceased to exist, for the simple reason that a non-illuminating gas can be made to yield a brilliant light by means of the now familiar mantle. It is therefore the calorimeter, and not the photometer, that should be the medium for determining the value of the gas supply in the consumers' interests. How far this change is likely to affect the present methods of gas manufacture, it is not wise to predict. At the outset, it cannot simplify the present methods to any appreciable extent; but the best means of obtaining the highest calorific gas from the coal nearest to hand may lead us into new fields of discovery, and enable us to abandon our present multiplication of unit methods of retorting for one of carbonization in bulk.

It would not be practicable, nor I think desirable, to supply at present a gas altogether devoid of illuminating properties. The first stage must be the abandonment of all enriching mediums, and the manufacture of gas from coal that can be procured at the lowest cost. We are so situated in this country that some reasonable degree of illumination must be yielded by the gas obtained from any coal we find it commercially advantageous to buy (as long as we continue to employ our present methods of carbonizing), and it should be sufficient for all purposes where it is necessary to consume it by the old-fashioned method; while the same gas may prove to have a higher calorific value, and be better suited for the incandescent mantle and for heating and gas-engine purposes.

Such a policy would result in an immediate reduction in the cost of gas to the consumer, and in a much wider field being opened for the utilization of gas for industrial purposes—resulting in considerable advantages to the community at large by reducing the now-recognized wasteful method of using coal direct in our houses and industrial undertakings, with its hideous accompaniment of smoke and soot polluting the atmosphere of our towns, to the detriment of the public health, and bedecking our buildings in the mournful garb of black. Even now we read of great schemes in course of prosecution for supplying such a gas to whole communities in the Midland Counties of England, to compete with the present supply of coal gas. One can scarcely realize that the promoters are in earnest when they propose to lay down a distributory system to convey a gas having a calorific value of only one-fourth or one-fifth the present coal gas supply under existing conditions. To do so, is to assume that the gas-consuming public are not alive to their own interests; and while in certain industrial centres where large volumes of gas of no degree of purity are required for purely industrial purposes such (or similar) schemes may be advantageously applied, its general application is out of the question.

The second stage of such a development depends upon many as yet unsolved problems—questions which can only be solved by the application of the highest scientific knowledge, and most searching investigations and experiments; research that may require years to complete, and prove to be commercially sound. The calorific value of gas produced from coal carbonized in bulk in some form of producer, with and without air-blast, added steam, or water gas, cannot be determined in a little while, as such investigations often lead one into paths unthought-of at the outset.

The admixture of water gas to coal gas while being generated in our present plant, as suggested last year, may still have untold advantages in it from a calorific point of view, as well as many other issues which come to the mind. Such investigations will demand a considerable degree of scientific aptitude from those actively engaged upon them; and their development and application to every-day operations, will also demand a still greater degree of technical skill to ensure their ultimate success. How are we situated as a profession to supply these wants which will inevitably arise in the near future?

We are told by statesmen that technical education is the only means by which the industrial supremacy of Great Britain can be maintained. We all readily admit the importance of, and urge the necessity for, a sound technical education; but I will presume to suggest that, generally speaking, as a nation we are not as deficient in this respect as may appear on the surface. I will further be bold enough to say that our principal deficiency lies in the want of a proper appreciation of the technologist. The necessity for the highest technical ability is not properly appreciated by the commercial administrators of the country's industries; and those possessing any technical knowledge, skill, and experience are not adequately remunerated by our manufacturers. As a consequence, they drift from our shores to develop the industries of other countries, which in turn compete with our own.

As regards the technical education of the rising generation of gas engineers, I think we may justly have considerable concern. The duties which a modern gas engineer is called upon to discharge are of such a numerous and complex character, that the ordinary span of life seems scarcely sufficient to enable one to become proficient in them all. From time to time, we hear lamentations that the right class of men are not entering the profession. This is probably partly attributable to the fact that gas has been out of fashion since the advent of the newer illuminant. But the signs of the times are such that we appear to be nearing the period when fashions change, and gas will be appreciated at its true worth. This may have a tendency to induce young men of good education and standing to enter the ranks. But here again I am inclined to suggest that the inducements offered are insufficient to attract the men we want. The principal object of any young fellow entering a profession is in order that he may secure unto himself an honourable position, and a competence sufficient to enable him to live with a moderate degree of comfort. The senior positions in the gas industry are of necessity limited; but the junior positions may be said to be numerous, and I think can be still further multiplied with considerable advantage to the concern from a commercial point of view.

There is also the important question that all minds are not equally capable of being trained to occupy the senior positions. Many young fellows can be made excellent use of in departmental supervision, who would be altogether incapable of ever undertaking the multifarious duties involved in the full responsibility of such an industry as a gas undertaking. Special minds should be selected and trained for special purposes, and a careful selection made from among the junior staff (whether they be workmen or otherwise) of those appearing to possess the necessary brains capable of development to fulfil the higher offices on the staff.

Any young fellow entering the profession, naturally hopes some day to occupy a high position; while at the same time he is keenly conscious of the fact that a great many years of subordinate service are before him. The question is, Does it offer sufficient inducements by way of salary to warrant the most likely men taking up these subordinate positions? I am inclined to say that it does not.

The present development of the gas industry renders it imperative that the profession must be recruited from the general engineering shops of the country. A would-be gas engineer must first have served some considerable time in a mechanical and structural engineering works, during which period his attention should be particularly directed to the following subjects, in addition to the every-day practice of the workshop: Mathematics, and its application to engineering science; physics, heat, light, and sound; electricity and magnetism; theoretical and applied mechanics; mechanical engineering and drawing; architecture and building construction; and masonry and brickwork and kindred subjects—incidental subjects (such as natural philosophy, strength of materials, geology, commercial correspondence, economic science, practice of commerce, &c.) being taken by way of recreation.

By the age of about 20 or 21, he should seek admission to a moderate-sized gas-works, where he should, in the first instance, act as assistant draughtsman, and supervise any constructional or mechanical work that may be proceeding; at the same time making himself proficient in the subjects formerly enumerated—adding to them the study of practical and theoretical chemistry, as well as the science and practice of gas manufacture in all its ramifications. Surely a man who has passed through such a course should be recompensed with a salary to enable him not only to live with a reasonable degree of comfort, but also to marry if he so desires.

Such a policy of departmental supervision by trained and competent men will redound in a high degree to the commercial prosperity of the undertaking, and raise the profession to a higher plane than it occupies at present. It will also have a tendency to prevent partially-trained young fellows, anxious to earn enough to keep themselves, from falling a prey to the so-called economical municipalities of the smaller class, and thus save them (the municipalities) and their ratepayers, in spite of themselves.

A very important point bearing upon this question of

technical education has relation to the compensation which the employer awards the employee who devotes his time and energies to the development of his brain in the particular line of life he has elected to follow. For a long time it has appeared to me that class certificates in the subjects directly akin to the work being performed by the operative, should have a determined face-value in the way of wages per week. None but born philosophers will work and learn for work's sake; and I think we may with advantage apply the commercial spirit to this question in a far greater degree than has been done in the past. To tell a young fellow who is spending the whole, or the greater part, of his leisure time in qualifying to fill a higher position, that some day he will be compensated, is, I think, unfair, and insufficient to encourage those habits of study and self-improvement which are the crying necessity of our age.

Every inducement should be given in hard cash to encourage the technical training of the whole of the staff, from the lowest to the highest; and it is only by giving direct monetary advantage that the majority will be induced to follow it. The days of chivalry are, I am afraid, gone by. We are living in a commercial age, wherein a man must barter his goods in the market place of life, whether they be brain or inferior matter. Few can afford to acquire knowledge for its own sake; and although we may lament this, we must accept the fact.

Technology alone, however, will not be sufficient to ensure success; a sound commercial spirit must pervade the whole, without which applied science is of very little utility. The commercial instinct must determine how far it is profitable to carry the scientific truths—whether to their ultimate issue or only partly so. A manufactory is not a laboratory, where the ideal can often be achieved, but a complex whole which must turn out a product approaching the ideal as far as practical conditions will permit, and such as can be bartered in the market place of every-day life.

The same remarks also apply to mechanical, as distinct from physical, technology. It is not always commercially sound to attain the highest degree of mechanical efficiency, or even to apply mechanical means to accomplish specific purposes. It is perhaps here that the complex character of the profession of gas engineering is made manifest. I know of no other calling where the technologist is required to take a more active part in the commercial administration of the industry than in a gas undertaking. Without the technical knowledge, the finest commercial intellect cannot successfully carry on such a concern as a gas-works; and it is for this reason that those undertakings which have the services of able technical men acting also as their commercial administrators, have been able to show such favourable results when compared with others where this principle has been neglected.

A sound commercial training must therefore be added to the many other things that a would-be gas engineer must take care to cultivate; and, in my humble opinion, the immediate future progress of our industry depends to a greater extent upon the commercialization of methods of transacting business with our customers than upon any great achievements in the field of applied science in the direction of improvements in the practice of gas manufacture. As business men, we must call to our aid every artifice that can be honourably employed to induce our customers to continue with us, and take every opportunity to bring before the consumers' observation the advantages and economies resulting from a more extended use of gas in the household, both for lighting and other purposes. We must take a more sympathetic interest in their welfare, and enable them to procure at the lowest possible cost appliances for which gas is used. As engineers, we must take every advantage of applying mechanical means to economize the cost of manufacture, and more particularly in the handling and transportation of the large quantities of material which is the principal part of our daily and hourly operations.

In many cases, it will even pay to apparently destroy parts of existing works, or completely abandon works and site, in order to accomplish this. Every penny saved per 1000 cubic feet of gas sold will warrant a very considerable sum of money being spent on improvement or reconstruction. Take the example of a works turning out only 1,000,000 cubic feet of gas per day. A penny saved per 1000 feet on the manufacturing costs will yield sufficient to pay 10 per cent. per annum upon an outlay of £8300. It is from this point we should view our economies, and if necessary plead for productive expenditure. There are many existing works where, for want of favourable traffic facilities, and also for want of modern appliances, many pence are wasted—sufficient, and more than sufficient, to pay the interest on the cost of entirely new manufacturing stations in more favourable situations.

Capital expenditure must not, however, be entertained unless we are absolutely sure of a full return for our money. We know too well that the water-logged capital of many concerns makes their administrators tremble at the very suggestion of further outlays. Such concerns are suffering from a deficiency of commercial foresight on the part of their earlier administrators; and I think it is greatly to be regretted that the practice of liquidating the capital debt has not been more largely indulged in. Municipal undertakings must do this; but in my opinion even they are doing so insufficiently, although probably equal to their statutory requirements. Gas companies, however, are under no such obligations; and many are unwisely neglecting to do it.

It is all very well to say: "But we always maintain our works and plant in a high state of efficiency." That may be so; but buildings and general arrangements which were sufficient for the most advanced practice twenty, or even fewer, years ago, are rendered obsolete by the ideas of to-day, and so may those of to-day be likewise unsuitable fifteen or twenty years hence, excepting in the case of large works, where the buildings are of such a character as to be applicable for almost any description of plant. Why, then, should their capital cost be carried for all time? Many gas undertakings, both private and public, have been wise in their time, and have written off large sums, and carried out extensions at the expense of the revenue, and thus acted in a sound commercial spirit; with the result that to-day they are selling the same product at considerably less than others in neighbouring towns where the same practice has not prevailed.

In my opinion, the first duty imposed upon a municipality acquiring a gas undertaking is to proceed to make the capital account truly represent the structural value of what they have acquired. This accomplished, any balance remaining to the credit of the revenue account is the property of the gas consumer, and should only be applied to his interest by reducing the selling price of gas. It may be said that to pay for structural extensions out of revenue must, in the case of companies working under the sliding-scale clauses, deprive the consumers, as well as the shareholders, of the trading profits to which they were legally entitled. But to prove this, it must first be shown that these undertakings have charged a higher rate than their neighbours similarly situated for the gas supply in the past. This, I think, cannot be proved; and the truth will be found in the fact that these concerns have been administered in a thoroughly commercial spirit. This has not only enabled them to keep level with their neighbours as to selling price, when perhaps there was not the necessity for reducing it below the average in their district, but their superior methods have enabled them to produce at a less cost, the results of which were being wisely applied not only to renewal, but to extension of plant and replacement of obsolete appliances, &c.—thus permitting them to draw upon these great reserves by having many pence less to pay in interest on capital per unit sold, and boldly face the keenest competition that we are now subjected to. Unless, therefore, it can be shown that undertakings which have practised this method of keeping down the capital ratio have charged a higher price for the gas supplied in the past than their neighbours, it must be admitted that the policy is sound, and such as should be emulated by all.

To step from the high plain of a profession to the line of a tradesman is not always easy; but such is the complexity of our calling, that in order to succeed we must play both parts. In the past, we have probably given too much of our attention to the professional part of our duties—or rather too little attention to the purely trading portion of our business. After all, we are very much on a par with the small ware-dealer, having, like him, a very large number of very small customers; and while in the past our product was a necessity, it no longer remains so now. Oil was once our only competitor. This we have annihilated as such, by the introduction of the prepayment meter, and the sale of gas by the pennyworth. Now, however, we have a much more aggressive rival in the form of the supply of electricity. I am not one who suggests, for a moment, that this competition has not been one of the greatest blessings that the gas industry has ever participated in, although it may have appeared in a disguise.

Notwithstanding the powerful influence of fashion, coupled with the prejudice always engendered against an old-established system, and, moreover, the fact that electricity has had at its command the highest scientists of the day, it has only been able, up to the present time, to acquire from 8 to 10 per cent. of the total volume of light demanded by the public. It has required a capital expenditure of approximately 25 millions to accomplish this; whereas the gas industry is supplying the 92 per cent. with a capital approaching 100 millions. Roughly speaking, therefore, our competitor must expend two-and-a-half times the capital to yield the same volume of light; these figures being based upon a comparison between the incandescent electric lamps yielding 240 candle-hours per unit of electricity absorbed, and the ordinary flat-flame burner yielding 3 candles per cubic foot of gas consumed.

Such a comparison, you will admit, is altogether unfair to gas, as at the present time a uniform average of at least 20 candles per cubic foot of gas can be acquired by the use of incandescent mantles. Notwithstanding the comparative insignificance, therefore, of the present position of our aggressive rival, we can learn a good deal by a careful study of the cause of their present success. The competition has clearly shown us, in the first place, that the consumer is to a great extent indifferent to the actual cost incurred in procuring the satisfactory lighting he desires. He has been easily persuaded, by a little judicious canvassing, and by a little explaining away of important fundamental truths, that it is in his own interests to pay more for the new, rather than try to improve the old, system of lighting.

Gas, on the basis of cost for light yielded, cannot be equalled. If, therefore, we only properly organize our business on an ordinary tradesmanlike basis, and approach our customers with a liberal spirit, giving them every opportunity of procuring at the lowest possible cost, or on the hire-purchase or hire system, all and every conceivable apparatus for which gas is admittedly applicable and advantageous, there is little doubt that the increase in our business will be even greater in the future than it has been since the advent of electricity. The enormous increase of the population in our large towns—the whole tendency of modern life being to concentrate within the suburbs of populous centres made accessible by quick and easy means of locomotion—gives a grand opportunity to the suppliers of gas to enforce what has for a long time past been admittedly necessary in the way of proper provision for the utilization of gas in the dwelling-houses in course of construction; the expense attending the general piping of the house in the first instance being a mere trifle as compared with the after-cost when once the property is finished.

Some organized system of inducing both architects and builders to recognize the necessity of providing for the introduction of gas cooking and heating stoves lies near our hand. We are not compelled to lay pipes into new districts at our own cost, and by refusing to do so (until reasonable provision has been made for the fixing of at least a gas cooking-stove, and perhaps the laying of one or two or more pipes to the sides of fireplaces in the occasional rooms for gas-fires) we shall compel the parties interested to make such provision as a condition precedent to the laying of the gas-mains in the streets in question. The regulations as to the size of pipes and the method of laying, and the inspection of the same in all new houses, now form part of the statutory powers of most concerns; and while I do not advocate an aggressive interpretation of these powers, I have not found it at all difficult to induce architects, builders, and others interested to make this provision when its advantages to the incoming tenant, or the purchaser of the property, have been properly laid before them. Some three years ago I took occasion to circularize all interested parties with regard to this, even where mains already existed; and it is now an established practice to send a copy of this circular to all parties concerned, whenever new property is seen to be in process of erection, either in old or new districts—the various inspectors being held responsible for giving due intimation of such new building proceeding.

Having secured the consumer, we must be prepared to devote more time and attention to his interests than has been customary in the past days of gas lighting. At the present time, the only visible embodiment of the suppliers of gas that the consumers come in contact with is the meter inspector, who, I am sorry to say, in the majority of cases is altogether ignorant and incapable of advising consumers how to overcome the slight defects and deficiencies commonly experienced in the gas supply by causes other than the initial illuminating power of the gas supplied, and how best to utilize the gas they burn in order to get the most economical results therefrom. Surely here we have a splendid opportunity of improving our position with our customers, by sending out in this capacity only trained men, who must not only be capable, but agreeably willing to assist and advise those they come in contact with; while a separate staff should be trained and deputed to procure new customers and superintend the fitting up of old and new property.

Whether the piping and fitting work should be done by the suppliers of gas or not, is merely a question of local consideration and convenience. I do, however, think that it is in the interests of the gas department to supervise this work in the interests of the consumers, and thus avoid, not only annoyance to him, but also possible expense to ourselves in the future, when we are called upon to remedy defects in the supply which are inherent in the pipes and fittings of the premises.

Many other points crowd into one's mind on this aspect of our business; and in all fairness it must be admitted that the majority of gas engineers are fully alive to the merits of such practices. Some have succeeded in obtaining their directors' and committees' sanction to the initiation of such practices on a more or less limited scale. There are, however, but few of us who could not do much more.

The directors and administrators of our industry must, where necessary, be awakened to the requirements of the times. The gospel of "it being sufficient for our time," so prevalent a few years ago, is commercially rotten. To keep the capital account down by throttling the development of the business, is even worse, as is also the policy of makeshift extensions resulting in patch-work construction and in extravagant expenditure in the end. The general industries of our country have already suffered far too much from such a policy in the past; while other more enlightened administrators have, to the older order, appeared almost reckless in their ideas of capital expenditure. It is not, however, the amount we spend that should govern, but how much we can be sure of earning by a judicious expenditure of capital upon improved processes and appliances. To know this, they must first be prepared to pay liberally for brains technically versed in the subjects dealt with; neither must they hesitate to pay liberally for brains to carry on the works when once established. It is the true appreciation of the relative properties of brains and capital with earning capacity, that has enabled the Americans to attain the pre-eminent position they at present occupy in the world of commerce.

The autumn meeting of the Institution was last year held in Paris, in consequence of our having received a cordial invitation to participate in the International Gas Congress which was initiated by the Société Technique de l'Industrie du Gaz en France. This, I believe, is the first time that an International Gas Congress has been held; and considerable credit is therefore due to the Société Technique and to its distinguished President (M. Théodore Vautier), for having conceived and carried to a successful issue such a unique gathering.

I was unfortunately unable to be present myself. I have, however, on former occasions had the privilege of meeting many of our Continental *confrères*, and have pleasant recollections of the courtesy with which I was received, and the kindness extended to me, at all the works I had the opportunity of visiting. So that I am sure the members of the Institution who availed themselves of the opportunity of visiting Paris, and taking part in the congress last year, are to be congratulated upon their good fortune. From the report of the proceedings, as far as the reading of the papers and technical matters are concerned, I think it stands as a unique record both as regards volume and worth, and has done a great deal to broaden the ideas of all who took part in it.

The holding of an International Exhibition in Glasgow during the present year has also brought about the inauguration of an International Engineering Congress, to be held early in September at the University Buildings, Glasgow, and of which "Gas" forms one of the sections. We shall therefore have an opportunity of laying before our international *confrères* the most advanced practice of gas engineering and manufacture, as applied to the necessities of our own country. It is perhaps impossible to excel in its international character the unique conference that was held in Paris last year; and we scarcely dare to hope that the

coming conference will be truly international as that was. We must bear in mind, however, that those who may not be able to be present will, through the Technical Press of their various countries, doubtless become fully acquainted with the proceedings thereat.

The Institution of Gas Engineers were requested by the inaugurators of the conference to take charge of the Gas Section; and this the Council agreed to do, but sought permission to share the honour with the Council of the Gas Institute, which was acceded to. Particulars of the aims and intentions of the promoters of the conference have already been made known to you; and it is not necessary for me to further refer to the question, than to express a hope that the subject-matter of the papers which are to be contributed by our own countrymen for the consideration of the congress, will truly reflect the position in which the British gas industry finds itself at the opening of a new century. I think perhaps also that, in the preparation of such papers, which are to be read in the light of experience in other lands, care should be taken to not only state methods and practices, but to clearly lay down the reasons why such practices have become established. For instance, in most towns in our own country we can depend upon regular deliveries of coal for (say) 300 out of 365 days; while there are towns on the Continent where they may possibly be shut out from the receipt of coal for three or four months of the year. Between such extremes there are, of course, various grades; and while, on the one hand, it is permissible to go to a large capital expenditure for the stacking of coal and its removal from the stores to the retort-house (as we have recently seen demonstrated at one or two of the Continental works), such a practice in the majority of our own works would be an altogether extravagant outlay of capital. There are other distinct points of difference between British and Continental practice; and I think an explanation of local conditions becomes very necessary under the circumstances mentioned.

Mr. HELPS said the preparation of the presidential address seemed to him to be a task which year after year did not become easier, and this must detract from the otherwise very pleasurable feelings with which one looked forward to his year of office. They expected much from their new President; and he thought all would agree that they had heard from him an address eminently practical and educational. Many hints had been brought before them, besides many lessons which it would be well for them to study and act upon. He begged to propose a hearty vote of thanks to the President.

Mr. G. C. TREWBY had much pleasure in seconding the proposition. In no previous address had he been in more entire accord with the author than in this.

The motion having been carried,

The PRESIDENT briefly returned thanks.

THE AMALGAMATION SCHEME.

The PRESIDENT then called upon Mr. Helps to read the report prepared by him on the above subject. He said this was a matter which was uppermost in all their minds, and deserved their closest attention.

Mr. HELPS read the following report; also his letter of Nov. 17, 1899, addressed to the then President of the Institution (Mr. F. D. Marshall), and the letter of the Secretary of the Gas Institute, dated Feb. 26, 1901, to the Secretary of the Institution, conveying the views of his Council on the subject of the amalgamation.

AMALGAMATION SCHEME.

Report Prepared by Mr. J. W. HELPS.

Although the subject of the amalgamation of the two Societies representing the gas industry in Great Britain and Ireland has for some years given rise to discussion among the members of both Associations, no really practical steps were taken in the matter until after the meeting of the Gas Institute in June, 1899, when certain letters were received by Mr. George Livesey from the then President and Honorary Secretary of the Gas Institute, which regarded very favourably the question of amalgamation. The President of the Gas Institute expressed his opinion that the dissolution of both Institutions and the formation of a new one would form the best, if not the only *modus operandi*. About the same time, a letter appeared in the Technical Press from Mr. Charles Hunt, making certain suggestions in support of the movement. [See Appendix A.]

Mr. Livesey thereupon wrote to Mr. Marshall, the President of the Institution of Gas Engineers, enclosing him copies of the correspondence, and suggesting "that the Council should take the matter into its earnest consideration." Copies of the letters were also sent by Mr. Livesey to each member of your Council. [See Appendix B.]

In accordance with Mr. Livesey's suggestion, a meeting of the Council was held on Sept. 3, 1899, at which this correspondence was carefully discussed. A resolution was finally passed, to the effect that the President should inform Mr. Livesey that it had been decided to call at an early date a further meeting of the Council, to which all past members thereof should be invited, with the object of securing full and complete consideration of the subject; and he was at the same time asked to convey this decision to the President of the Gas Institute.

In accordance with the above resolution, a meeting was held on Oct. 19, 1899, and after very full discussion, it was unanimously resolved that, provided the conditions of qualifications of membership could be satisfactorily arranged, re-union would be desirable, and the Chairman of the meeting (Mr. J. W. Helps, Vice-President) was instructed to convey this opinion to Mr. E. H. Stevenson, the President of the Gas Institute. This was done in a letter dated Oct. 30, 1899, which also contained a suggestion that it would be well if the writer could meet Mr. Stevenson and confer with him on the subject. [See Appendix C.] This meeting took place on Nov. 7, Mr. Dougall, the Honorary Secretary, attending with his President. The details of the conference, after being submitted to Mr. Stevenson, were embodied in a letter written by Mr. Helps to Mr. Marshall on Nov. 17, copies of which were sent to the members of your Council. [See Appendix D.] Perusal of this communication will show that Messrs. Stevenson and Dougall expressed themselves as entirely in accord with the Council of the Institution of Gas Engineers in their desire to exclude from any new organization those usually described as "traders." They further expressed the opinion that existing members of the Gas Institute who would be included in this category were willing to withdraw, if, by doing so, the prospects of re-union would be improved; and also that the best, if not the only, way of bringing about such re-union would be to dissolve both Associations, and to form a new one with satisfactory rules providing for the above requirements as to membership. It was at the same time suggested that it would be advisable for the Councils of the two Associations to meet and to appoint a certain number of their members to form a Joint Committee to carefully discuss the situation, and to draw up for the approval of the members generally a set of rules suitable for the regulation of the new Institution.

It will be noticed that so far, throughout the proceedings, the principle of the exclusion of traders, and the necessity for dissolution, had been accepted without dissent by both sides.

In due course, Mr. Stevenson laid the details of the conference before his Council, and wrote on Dec. 4, 1899, to Mr. Helps, stating that they had considered the matter very fairly, and—except upon the one point of having two classes of members and altering the status of old members in the new Institution—they were, so far as he could see, unanimous in advocating the proposals embodied in the letter which had been sent to the President and members of the Council of the Institution of Gas Engineers. [See Appendix E.] At the same time Mr. Stevenson stated that a Sub-Committee had been appointed, as suggested at the aforesaid conference; and shortly afterwards your Council met and appointed a similar body. In due course the Joint Committee held several meetings, while numerous others took place between the Joint Honorary Secretaries, Messrs. Dougall and Helps, at which the detail work was carried out. From the minutes of the meetings taken at the time, it would appear that the opinion was general, that all existing members of both Institutions, *except such as were engaged in trade*, should be eligible for election to the new Institution. It was, however, suggested that honorary members should not be eligible. It was also stated that your Council would probably be prepared to leave the name of the new Institution in the hands of the Gas Institute, *provided that the name of that Association should not be selected.*

The final result was the drawing up of a set of rules, which received the unanimous approval of the Joint Committee, and afterwards of your Council. Copies of the rules were then printed and circulated prior to the general meeting held in May, 1900, at which they were carefully considered; and, after some discussion, the following resolution was unanimously passed: "The members of the Institution of Gas Engineers, having considered the question of an amalgamation being brought about with the Gas Institute, are of opinion that it would be to the best interests of the gas industry that such a course should be adopted; and they therefore wish to express their approval of the action of the Council in the matter and of the rules drawn up by the Joint Committee, and their desire that the necessary steps be taken to carry out the proposed scheme in accordance with the principles of the draft rules submitted to the meeting."

Shortly afterwards the proposed rules were laid before the Council of the Gas Institute; and, on May 9, the President of the Gas Institute addressed a letter to Mr. Charles Carpenter, in the absence abroad of Mr. J. W. Helps, suggesting certain alterations. [See Appendix F.] The first referred to the name of the new Association, which the Council suggested should be the Gas Institute; the second had for its object the provision of a larger representation for the Institute than for the Institution in the signatories to the Articles of Association; while the third required a reduction in the annual subscription and entrance fee. A further letter was received by Mr. Carpenter from Mr. Stevenson, dated May 21. [See Appendix G.] In reply, a communication

was sent, dated May 23, covering minutes of Council, agreeing to the proposed alterations with regard to subscription, &c., but stating that the Council could not entertain the two other proposals. [See Appendix H.] As nothing further was heard from the Gas Institute, it is believed that the rules (with the above slight amendment) received the sanction of their Council; and at the general meeting held in June, they were laid before their members.

At this meeting, the first resolution—"That it is desirable that the Incorporated Gas Institute, and the Incorporated Institution of Gas Engineers, be amalgamated"—was carried without dissent. The President then moved—"That it is desirable that such amalgamation be effected by the voluntary liquidation of the Incorporated Gas Institute and the Incorporated Institution of Gas Engineers, and by the transfer of all the property and assets of these two Societies to a new Society, to be registered under the 23rd section of the Companies Act, 1867, by the name of the Society of Gas Engineers and Managers (incorporated 1900), having a Memorandum and Articles of Association in the form of the draft issued to the members, and produced to, and approved by, this meeting, and identified by the signature of the President, subject to such alterations (if any) as may be approved by the Council."

After a lengthy discussion, during which several amendments were brought forward, the resolution for voluntary winding-up the Institute was put to the meeting, with the result that, on a show of hands, 95 voted in favour of, and 37 against it. It was therefore declared to be lost, as the requisite three-quarters majority was not obtained. A poll was then demanded, and taken later in the day, when 86 voted in favour of the resolution, and 64 against.

Later during the meeting, the matter again engaged the attention of those present; and eventually a resolution was unanimously passed, recording appreciation of the labours of the President and Council, and requesting them to continue their efforts towards securing a satisfactory agreement. [See Appendix J.] A copy of this resolution was sent to the President of this Institution; and this was shortly afterwards followed by a letter (dated June 28) containing a request for the views of the Council on the subject, and for any proposals which they might desire to make. A reply was sent, briefly recapitulating the steps already taken, and stating that your Council were not prepared to make any further suggestions, but that they would willingly consider any communication which the Institute might be pleased to submit. [See Appendix K.]

On July 20, a meeting of the Council of the Gas Institute was held, and a resolution was passed recommending the addition to clause 4 of the draft Memorandum of Association of certain words which would give to the Council of the proposed Association power to re-elect or elect certain gentlemen who, at present belonging to the Institute or the Institution, would not otherwise be eligible under the proposed new rules. A letter, dated July 21, 1900, containing this resolution, was sent to the Secretary of this Institution. [See Appendix L.] It was not, however, deemed advisable to call a special meeting for its consideration; and of this the Institute was informed. A copy of their letter was, however, sent to each member of your Council. The Autumn Meeting of the Institution, held in Paris during the month of September, intervening, no formal steps were taken until Oct. 11, when, at a meeting held on that day, a resolution was passed to the effect that your Council, being desirous of meeting the views of the Council of the Institute, and fully appreciating their suggestion that, while there were among the members of the Institute "some names on the roll which it will be desirable to exclude from the new Association," there were others who should be connected with the new Association, but who were disqualified under the agreed rules, accordingly invited the Council of the Institute to submit the names of those whom they would be desirous of retaining. A copy of this resolution was forwarded to Mr. Dunn, who laid it before his Council at a meeting held on Oct. 19. [See Appendix M.] The result of its consideration was the receipt by your Secretary of a letter [See Appendix N] giving a copy of a resolution passed at the above meeting, to the effect that the course suggested by the Council of the Institution—viz., to select the names of those whom it would be desirable to "*exclude from*" the new Association—would present very great difficulties, and at the same time suggesting that a conference of the respective Councils should be held for the discussion of the various questions involved. It will be observed that the reference to the suggestion of your Council is not quite in accordance with the copy sent to Mr. Dunn on Oct. 15, inasmuch as the words, *exclude from* were not used in that suggestion; and correspondence on this point took place between the two Secretaries. [See Appendices O and P.]

The resolution contained in Mr. Dunn's letter of Oct. 24 [See Appendix N] was carefully considered by your Council at a meeting held on Jan. 5, 1901, when it was unanimously resolved to agree to the suggestion of the Gas Institute, that a conference of the two Councils should be held; and Feb. 2 was suggested as a suitable date. This was, however, altered to Feb. 9, on account of the funeral of the late Queen, when, by the courtesy of the Institution of Civil Engineers, the meeting was held at No. 22, Great George Street.

After considerable discussion, it was finally decided, on the suggestion of the Chairman (Mr. J. W. Helps), that the views and requirements of the Council of the Gas Institute, as expressed at the meeting, should be put into writing and submitted to your Council at an early date. This was accordingly done [See Appendix Q]; and on March 30 the matter received the careful attention of your Council, who decided that a reply should be sent to the Secretary of the Institute, stating that as the letter of Feb. 26 raised new issues, the Council considered it best to lay before their members a report of the whole proceedings up to the present time, and take their instructions therefrom. [See Appendix R.] It is in accordance with this resolution that this report has been prepared.

In conclusion, your Council beg to point out that, throughout the earlier stages of the negotiations, no desire was manifested to depart from the principles laid down at the early conferences—viz.: (1) That dissolution was necessary. (2) That those described as traders should not be admitted to membership. (3) That neither the name of the Gas Institute, nor that of the Institution of Gas Engineers, should be selected as the name of the new Association. Yet in the final communication received from the Council of the Gas Institute, all three of these main principles are departed from; and the whole scheme, as now suggested, resolves itself into a voluntary liquidation on the part of the Institution, and a transference of its members to the Gas Institute, which mode of procedure it is felt is diametrically opposed to the views of the members as from time to time expressed.

Your Council venture to express the hope that the members will be prepared to carefully discuss, and definitely state their opinion, on the whole subject when this report is presented.

Appendix A.

Letter, dated June 19, 1899, from Mr. A. Dougall *to Mr.* George Livesey.

Dear Mr. Livesey,—I was much gratified by what took place at our meeting last week, when you and Mr. Bray attended. Matters have progressed rapidly since we had that chat on the boat less than a year ago; and I trust before long we shall see our forces once more united, and a representative Institute formed. I do not think, however, we can do more until we have some overture from the Institution; and I, personally, hope you will do your best to bring this about. I have been quietly "pegging away" at this for years; and it gives me very great satisfaction to see the course things are taking. At the same time, one cannot but feel much remains to be done; and I know your influence can accomplish a great deal.

Letter, dated June 23, 1899, addressed by Mr. Charles Hunt *to the Editor of the* "Journal of Gas Lighting."

Sir,—The proceedings at the recent meeting of the Gas Institute show how greatly the desire for re-union has gained ground; and what is so generally felt would be of advantage to the gas industry should be worth striving for, even to the suppression of personal feeling or inclination.

One great obstacle to unity seems now to have been removed; and the rest should not be impossible to accomplish.

If we all agreed as to what, for the future, ought to be the sole qualification for membership, here is an opportunity for a new organization upon a wide and firm basis. The various District Associations have done excellent work in the past; but it can hardly be denied that some of them have during the last few years shown less vigour than formerly. Why should they not renew their youth as Sections of one great national institution upon the lines, say, of the Society of Chemical Industry, or the Association of Municipal Engineers? to which they would be a source of strength, and in the management and advantages of which they could participate.

This is not a new idea; but it may not be thought less deserving of consideration on that account.

Letter, dated July 10, 1899, from Mr. E. Herbert Stevenson *to Mr.* George Livesey.

Dear Mr. Livesey,—My attention has been drawn to a letter in the "Gas Journal" of June 27 from Mr. Hunt, in reference to the mention at the meeting of the Gas Institute as to re-union.

From the tone of the letter, I gather that Mr. Hunt is not unwilling that the re-union should take place; and the line which perhaps he shadows only faintly is, I think, a very good one—namely, that both Institutions should be dissolved, and that a new one should be constituted, to which all members of the existing Institutions who should be eligible should be elected.

Such election would be effected through the medium of a Committee formed of members of the Council of both Institutions.

I do not think it would be wise for me, as President of the Gas Institute, to write in answer to Mr. Hunt, nor perhaps would it be wise for the Incorporated Gas Institute as a body to take any steps in the matter. They have already expressed their willingness to amalgamate; and I would submit that the next step should come from the Institution of Gas Engineers.

I believe that this is a very good opportunity for bringing about this much-desired reconciliation; and, if you would only lend it your countenance, I feel convinced that you could carry the members of the Institution of Gas Engineers with you, while I am sure that the large majority of the members of the Institute would eagerly accept any scheme which did not at the same time seem to put them in the wrong.

Will you kindly give this matter your consideration and let me know what you think of it.

Appendix B.

Letter, dated July 24, 1899, from Mr. George Livesey *to Mr.* F. D. Marshall.

Dear Mr. President,—I send herewith copies of some letters on the subject of a possible re-union of the Gas Institute and the Institution of Gas Engineers. Such re-union if practicable, as it now seems is the case, is undoubtedly eminently desirable.

It seems to me that the informal overtures made by the Honorary Secretary and the President-Elect of the Gas Institute, open the way for negotiations, and that, as they suggest, the next move should come from the Institution. May I, therefore, suggest that the Council should take the matter into its earnest consideration.

APPENDIX C.

Letter, dated Oct. 30, 1899, *from Mr.* J. W. HELPS *to Mr.* E. HERBERT STEVENSON.

Dear Mr. Stevenson,—On Thursday, the 19th inst., a meeting of the Council of the Institution of Gas Engineers was held to which Past-Presidents and previous members of the Council were invited.

The meeting was of a representative character, and the correspondence which had passed between you and our President, and also letters from Mr. Livesey and Mr. Hunt, on the question of the re-union of the Institution of Gas Engineers and the Gas Institute, were read.

The question was carefully and thoroughly discussed; and those present were unanimously of opinion that, "if the conditions of qualification of membership could be satisfactorily arranged, re-union would be desirable." Do you not think that it would be well if you and I could meet and have a talk over the matter, when we could possibly come to some conclusion as to what further steps would be advisable?

I am writing this at the request of the Council, as in the absence of our President (Mr. Frederick Marshall), I occupied the chair on the occasion of the above meeting.

APPENDIX D.

Letter, dated Nov 17, 1899, *from Mr.* J. W. HELPS *to the* MEMBERS OF COUNCIL.

Dear Sir,—I am appending herewith a copy of a letter I have addressed to Mr. Marshall, the President of the Institution of Gas Engineers, giving him particulars of an interview I had with Mr. E. H. Stevenson, President of the Gas Institute, on Tuesday, the 17th inst.; and I shall be glad if you will kindly favour me with your views thereon.

[Enclosure.]

Dear Mr. President,—You will have gathered from particulars already sent you, that at a meeting of the Council, held on Thursday, the 19th of October last, to consider the question of the suggested amalgamation between the Institution of Gas Engineers and the Gas Institute, a resolution was unanimously passed to the effect that—"Provided satisfactory conditions regulating the qualification of membership could be arranged, re-union is desirable." It was also resolved that I, as Chairman of the meeting, should acquaint Mr. E. H. Stevenson, the President of the Gas Institute, of this decision, and also if possible arrange an interview with him for the purpose of obtaining his opinions on the subject. This I accordingly did; and I beg herewith to lay before you some details of the views which were expressed by Mr. Stevenson, and by Mr. Dougall, the Honorary Secretary of the Gas Institute, who was present at the request of the former.

In the first place, both gentlemen expressed themselves entirely in accord with the Council of the Institution of Gas Engineers in their desire to exclude those who are usually described as "traders," and in this respect I was assured that many of the members engaged in trade had already expressed their desire to withdraw, if their action would assist in furthering re-union.

Messrs. Stevenson and Dougall also believed that, by dealing with the principals of firms, there would be no difficulty in ensuring the co-operation of such members as acted as their representatives.

The conclusion was therefore arrived at that there appeared to be nothing insuperable in the way of re-union, and the best way, if not the only way, to ensure this being brought about would be to dissolve both Associations, and to form a new one, with rules similar in many respects to those at present existing, but with the qualification of membership so defined as to meet with the necessary requirements.

Mr. Stevenson suggested that there should be three classes of members—namely:—1. Members comprising gas engineers, managers of important works, and possibly managers of smaller works, provided that they had been regularly trained as gas engineers. 2. Associate members, comprising managers of smaller works, assistant-managers, and such secretaries of gas companies who are exclusively employed as such. 3. Honorary members, to consist of those who have made themselves eminent in scientific pursuits connected with the gas industry.

Mr. Stevenson, of course, however, saw that his suggestions as above might be subject to modification.

It was evident that the disposal of funds need form no hindrance, as the rules of both Institutions provide that—"If upon winding-up or dissolution, after paying all debts and liabilities, including the cost of winding-up, &c., there should remain any property whatsoever, the same *shall be given* or transferred to some other Institute or Institution having objects similar to the objects of the Institute or Institution."

Finally, it was thought that the best course to pursue would be to call together the Councils of both Associations, and for each to appoint a few of their members to form a small combined Committee with power to draw up such rules as they consider suitable for the new Institution, and to afterwards submit these rules to their respective Councils. In the event of their being satisfactory, steps would then be taken by the Council of the Gas Institute to ensure the co-operation of the trading members at such time as the resolution in favour of dissolution should be brought forward. It would then be necessary to acquaint by circular the members of both Institutions of the steps that had been taken, and possibly to ventilate the subject in the Technical Press.

At the annual meetings of both Institutions, resolutions would be submitted recommending dissolution; and if these were carried in both, the course would be made clear for the completion of the necessary negotiations with regard to the final formation of the new Institution.

It might, of course, be urged that, as the meeting of the Institution of Gas Engineers takes place prior to that of the Gas Institute, it would be unfair to ask the members of the former to pledge themselves to a course which might possibly not be adopted by the members of the Gas Institute at their meeting later. It must, however, be remembered that any such resolution would have to be brought forward for confirmation at a meeting of the Institution to be held some months later; and, if it were not confirmed, matters would remain as they were prior to the May meeting.

With regard to the name of the new Institution, Mr. Stevenson and Mr. Dougall, while both acknowledging that the name borne by the Institution of Gas Engineers was an extremely good one, held the opinion that it would be better not to adopt in its entirety the title of either Association, but to decide upon a fresh one which might possibly embody both.

APPENDIX E.

Letter, dated Dec. 4, 1899, *from Mr.* E. HERBERT STEVENSON *to Mr.* J. W. HELPS.

Dear Mr. Helps,—We had our meeting at the Institute last Monday. The Council considered the matter very fairly, and except upon the one point of having two classes of members, and altering the status of the old members in the new Institution, they were, as far as I could see, unanimous in advocating the proposals I put before you, and which were embodied in your letter to your President. The Council appointed five gentlemen as a Committee—namely, the two Vice-Presidents, myself, Mr. Porter, and Mr. Dougall.

I trust your Council will soon meet and appoint a similar number to confer with us; and I think you will find that there will be every desire on the part of our Committee to bring the matter to a satisfactory conclusion.

APPENDIX F.

Letter, dated May 9, 1900, *from Mr.* E. HERBERT STEVENSON *to Mr.* C. C. CARPENTER.

Dear Mr. Carpenter,—At a meeting of the Council of the Gas Institute held on Friday last, the rules for the proposed new Association came up for discussion; and upon three points only, so far as the rules are concerned, was there any suggestion for alteration, and upon these three points for all practical purposes I think we must take it that the Council of the Gas Institute are unanimous.

The first one was as to the title; and on this point the Council took the view which was finally adopted, because in their opinion it would very much tend to the strengthening of the hands of the Council in bringing the matter before their members and induce many of the members to vote for the matter, rather than if the title were altered. The suggestion of the Council upon this point is that the title of the new Association be "The Gas Institute, Incorporated 1900." The Council I think were unanimous upon this point, because I was able to assure them, from what Mr. Helps and you and others had said to me, that the question of the title was quite a secondary matter, and in the opinion of those best qualified to judge, it would be of great assistance to us in carrying the matter through. I have not a shadow of a doubt that the members of the Joint Committee appointed by the Institution will agree to this.

The next point was one which, perhaps, you may remember, I shadowed as being very probable at our last interview—namely, that properly qualified members of the Gas Institute should have the right of becoming members of the new Association without any increase in the subscription. As is well known to most members of the Gas Institution, many members of the Gas Institute are comparatively poor; and it is strongly the opinion of most members of our Council that any attempt to put the members of the Gas Institute into what may be called a lower class in the new Association would tend to wreck the proposed amalgamation.

The only other point was that in the opinion of the Council an entrance fee of one guinea is sufficient, whether a man be elected as member or associate member, and that the only difference should be in the amount of the subscription.

I enclose a copy of the Memorandum of Association, &c., and have shown in red the proposed alterations. They are all embodied in the first two pages of Articles of Association; and I think that some of the other articles require alteration.

Will you kindly, in the absence of Mr. Helps, communicate with the other members of the Joint Committee, and ascertain whether they will be willing to recommend these alterations to their Council.

I can assure you that it will greatly assist us if the alterations be agreed to by the Institution of Gas Engineers.

There was one other point raised, which possibly might not be made a *sine quâ non*, but upon which several members of the Council expressed themselves pretty freely. In their view, they consider that the representation on the new Council should be somewhat more in proportion with the numbers of the two Institutions.

After considerable discussion, it was resolved that the Institution of Gas Engineers should be requested to assent to the signatories of the Articles of Association, and the Memorandum, being in the proportion of ten gentlemen nominated by the Institute and six by the Institution. I presume that the two Presidents would also be elected as Honorary Members of Council, so as to make the first Council up to eighteen. I may say that personally I do not care for a moment what the constitution of the new Council may be; but some of the members of our Council were very strong upon this matter. It is not a thing which can be put into the Articles of Association, nor can we arrange it otherwise than as an honourable understanding between ourselves; and I will see that any arrangement that may be come to shall be fairly carried out.

Will you kindly let me know your views, and those of your colleagues, upon these points as soon as possible, so that I may be able to communicate them to the members of our Council.

APPENDIX G.

Letter, dated May 21, 1900, *from Mr.* E. HERBERT STEVENSON *to Mr.* C. C. CARPENTER.

Dear Mr. Carpenter,—I have received from Mr. Dunn a statement of his conversation with you on Friday afternoon.

I note that you are to have a Council meeting to-morrow to consider these points; and I would ask your Council to consider whether the

title you propose of the Gas Institution is a good one. It appears to me that the Gas Institution is wrong altogether. It should be either Gas Institute or Institution of something or other. There is no doubt in my mind, or in that of the members of my Council, that it will materially assist us in carrying the matter through if the title remain the Gas Institute; and I would, therefore, ask your Council to agree with this if they possibly can.

My only other remark is as to the number of signatories; and I quite agree with you that they should be an equal number from each body. I do not think that this will be strongly contested, especially if the title as my Council suggested be agreed to.

I intend, as soon as I hear what your Council have decided, to write to each member of my Council, and state the result of your deliberations. I shall strongly advise that the signatories to the Memorandum of Association be an equal number from each existing Society.

APPENDIX H.

Copy of Minute of Council Meeting, Institution of Gas Engineers, May 22, 1900.

1. In reference to the name of the new Society. "That this Council oppose the new body taking the name of either of the existing Institutions, and propose: the Institution of Gas Managers; or the Institute of Gas Managers; or the Society of Gas Managers."

2. In reference to the subscription. "The Council do not agree to alter clause 4, section 2; but propose that clause 10, section 3, should read: (*a*) Every member shall, on election, pay an entrance fee of one guinea, and an annual subscription of one guinea." To delete clause 11.

3. As to the signatories to the Articles of Association, the Council do not agree with the proposed proportional representation of the two Societies, but contend that there should be an equal number from each Institution.

APPENDIX J.

Letter, dated June 13, 1900, from Mr. W. T. DUNN *to Mr.* J. W. HELPS.

Dear Sir,—I am desired by the Council to transmit to you, copy of resolution which was passed unanimously at the meeting of this Institute this afternoon, as follows: "That as the desirability of union of the Incorporated Institution of Gas Engineers and the Incorporated Gas Institute was unanimously resolved by the members of the Institute, as shown by the voting yesterday, we desire to place on record our appreciation of the labours of the President and Council in endeavouring to bring about the amalgamation, and earnestly request them to continue their efforts to secure a satisfactory agreement, and to call another meeting of the Institute to consider and vote upon their proposals at the earliest opportunity."

APPENDIX K.

Letter, dated July 16, 1900, from Mr. THOMAS COLE *to Mr.* WALTER T. DUNN.

Dear Sir,—Your letter addressed to the President of this Institution, was read and considered at the meeting of my Council held here on the 7th inst.

I am desired to preface my reply thereto by briefly recapitulating the steps to bring about re-union, in which this Institution took part.

In the first place, a Joint Committee constituted of an equal number of members from both Societies was appointed, with power to discuss and arrange a basis for re-union. The President of the Gas Institute was elected Chairman of this Committee.

As the result of its deliberations, a draft of Articles of Association and rules for a new Society to be formed to take over the assets of both existing ones, was unanimously agreed upon. A copy of the rules so agreed was placed in the hands of every member of this Institution; and at the general meeting held in May last, these were unanimously adopted by the members.

Some further modifications were subsequently suggested by your President as likely to be acceptable to your members; and these were fully and carefully considered by my Council, and in the main accepted by them on behalf of this Institution.

My Council have no idea of what points are now at issue, since the principle of dissolving both bodies to form a new one, with rules acceptable to both, was unanimously agreed upon by the Joint Committee under the chairmanship of your President, and, it is understood, adopted by the Councils of both Societies.

Under these circumstances, my Council have no further suggestion to offer; but, in saying this, I am desired to add that they will be prepared to consider any communication your Council may be pleased to submit upon the matter.

APPENDIX L.

Letter, dated July 21, 1900, from Mr. WALTER T. DUNN *to Mr.* THOMAS COLE.

Dear Sir,—I am desired by the Council to inform you that, at their meeting held yesterday, to consider further the question of the proposed amalgamation, in pursuance of the resolution passed by the members at our recent annual general meeting, the following motion was unanimously approved of: "It is proposed by the Council that, to clause 4 of the draft Memorandum of Association, the following words be appended: 'but it shall be optional for the Council, with the approval of the members, to re-elect any person, or to elect any person, who belonged to the Incorporated Gas Institute, or the Incorporated Institution of Gas Engineers, who, in their opinion, has in the past rendered such services to the gas industry, as warrants such re-election or election.'"

I am glad to add that the Council are of opinion that, while there are some names on the Institute roll which it will be desirable to exclude from the new Association, they feel that other names occur of those who should be connected therewith, but who would be debarred if clause 4 were passed as framed originally.

Will you kindly have this letter brought under the consideration of your Council as soon as possible.

APPENDIX M.

Letter, dated Oct. 15, 1900, from Mr. THOMAS COLE *to Mr.* W. T. DUNN.

Dear Sir,—Your letter of July 21 was laid before my Council at a meeting held on Oct. 10, and was very carefully discussed.

They feel that such an addition to Rule 4 as your Council suggest has many objections, and would not meet with the approval of the members. At the same time they quite appreciate the truth of the statement made in that latter part of your letter—viz., "that while there are some names on the Institute roll which it will be desirable to exclude from the new Association, they feel that other names occur of those who should be connected therewith, but who would be debarred if clause 4 were passed as framed originally."

They therefore suggest that, as probably there are but few members of this latter description, the two Councils should agree upon the names. My Council therefore suggest that your Council should submit the names of those they would wish to retain, with a view to getting over the difficulty by including the names of such gentlemen in the Articles of Association, rather than by providing for their election by a separate clause.

APPENDIX N.

Letter, dated Oct. 24, 1900, from Mr. WALTER T. DUNN *to Mr.* THOMAS COLE.

Dear Sir,—Replying to your letter of the 15th inst., I beg to inform you that it was duly laid before the Council of this Institute, at their meeting on the 19th inst., and that the following resolution was unanimously passed on the subject: "That the Council of the Incorporated Gas Institute having carefully considered the suggestion offered by the Council of the Incorporated Institution of Gas Engineers to select the names of those whom it would be desirable to exclude from the proposed new Institution, feel that such a course presents very great difficulties, and that it would be inadvisable to adopt it. They believe that the prospects of amalgamation of the two Societies might be much improved if a conference of the respective Councils were to be held with a view of affording the opportunity of discussing together the remaining questions involved, and desire that the Council of the Incorporated Institution of Gas Engineers may suggest a date, time, and place where such a meeting may be held, as soon as possible."

Will you be good enough to communicate this resolution to your Council without delay.

APPENDIX O.

Letter, dated Oct. 30, 1900, from Mr. THOMAS COLE *to Mr.* W. T. DUNN

Dear Sir,—In reference to yours of the 24th inst. Your resolution refers to the suggestion of my Council, that the Council of the Incorporated Gas Institute "should select the names of those it would be desirable to *exclude from* the proposed new Institution." "Exclude from" is apparently written in error for "include in"—*vide*, my letter to you of Oct. 15, last paragraph. "My Council would therefore suggest that your Council should submit the names of those they would wish to *retain*," &c.

APPENDIX P.

Letter, dated Nov. 3, 1900, from Mr. WALTER T. DUNN *to Mr.* THOMAS COLE.

Dear Sir,—In reply to your letter of the 30th ult., I beg to say that the wording of the resolution quoted in my letter of the 24th ult., is correctly given as there stated.

The selection of names of those whom it would be desirable to retain in the proposed new Institution would, of course, involve the selection of those to be excluded; and it is with regard to these latter that my Council foresee great difficulties, if the selection of names in the manner suggested by your Council were attempted.

APPENDIX Q.

Letter, dated Feb. 26, 1901, from Mr. WALTER T. DUNN *to Mr.* THOMAS COLE.

Dear Sir,—As arranged at the conference on the 9th inst., my Council have prepared the following as the expression of their views with reference to the above, and desire me to transmit it to you, with the request that you will be so good as to put it before your Council as soon as possible.

[Enclosure.]

Having carefully considered the question with regard to extraordinary members and associates, with a view to seeing how far it is possible or practicable to eliminate some and retain others, we find the difficulty increases the further we go; and after carefully looking through the list, we come to the conclusion that the number is so few whom we should desire to exclude, that we think it scarcely worth while to enter into any personal matters for the sake of so small a consideration. Further, having in view the fact that this class of member has reduced so very considerably during the last few years by death and other causes, also through care having been taken by the Council during the last few years in not adding to the number, that they might now be left to a process of natural elimination.

We strongly urge that you will see your way to recommend your members to accept the list as it stands, feeling that it is the best way out of a very difficult position.

We will favourably consider any rule that shall make it either impossible for any additions to be made to this list in the future, or that it may be optional for the Council to exercise its judgment in the selection of such men whom they may feel are likely to be of service to the Institute, or otherwise, as you think best. This our Council feel is the only way of getting over the difficulty; and we earnestly trust it will commend itself to you.

Touching the matter of dissolution, we feel very strongly that a dissolution of the Gas Institute is not expedient or wise; and on this point we urge very strongly that you give the matter your most favourable consideration, for the following reasons: In the first place, we like the name the "Gas Institute." We think it is most appropriate, most

fitting in every way, and cannot be changed for a more suitable name that will cover the whole body of gas engineers when once they are united. We also believe it will save very considerable trouble in the matter of bringing together the two bodies. Further, there will be a considerable saving in the matter of expense and time. We shall not require any legal assistance to enable us to draw up a new constitution. The matter of sentiment, of course, must enter into all these considerations more or less; and we acknowledge that we have a strong sentimental feeling with regard to the preservation of a body that has existed for so many years, and therefore we would like you, if you can possibly see your way, to urge upon your members the desirability of preserving the "Gas Institute."

We would suggest, as a simple means of bringing about the amalgamation, that the whole of your members should be transferred without the formality of an election; that you should nominate six of your members to be added to our Council; and that you should nominate the President for the coming year, and the Junior Vice-President, who should succeed Mr. Dougall; or any other better proposal that you may suggest.

As to the alteration of rules, in order to comply with your wishes as far as may be, after due notice has been given, they can be passed at the next general meeting.

APPENDIX R.

Letter, dated April 1, 1901, *from Mr.* THOMAS COLE *to Mr.* W. T. DUNN.

Dear Sir,—I have to inform you that your letter of Feb. 26, conveying the expression of the views of your Council with reference to the above, was read and considered at a meeting of my Council on the 30th ult.

I have to state that, inasmuch as your communication raises new issues, my Council consider it advisable that they should lay before their members a report summarizing the whole of the amalgamation proceedings from their commencement down to the present time, and take their instructions thereon.

Arrangements will accordingly be made that this shall be done at the general meeting in May.

The PRESIDENT said the proposal amounted to an absorption rather than a union; and he thought that the members would fully appreciate the reasons of the Council in their having determined to bring this question before the meeting to-day. Last year a definite scheme was submitted to them, and they unanimously approved of it; and it was ultimately laid before the Gas Institute. The reasons lying upon the surface at that meeting principally had regard to the facts that the new rules excluded from the membership of the proposed association certain gentlemen who, it was generally agreed, should by all possible means be made eligible for membership of it. The Gas Institute rejected the proposals; but on the following day they passed resolutions which still kept the door for negotiations ajar. Then, when they approached this Council, they continued the negotiations, never dreaming for a moment that the bases which had been originally settled had been altered. Various transactions took place until the conference in February last, when, he was sorry to say, it was discovered that there was an entirely new set of suggestions altogether, which were practically embodied in the letter that was the written record of what took place on the occasion. Upon this the Council of the Institution had no authority to negotiate, nor were they prepared to advise the members to continue on such a basis. Keenly as they felt the necessity for unity, they could not recommend such a sacrifice of principle as it would involve. The Institution was founded on very clear principles. It was an Institution of professional men; and it was felt that only men actively engaged in the management of gas-works, or employed professionally in their construction, were the proper men to form an association representing the gas industry at the present time. The Council did not see that it could be possible to deviate from this principle, which was most decidedly that which governed the formation of the Institution; and they did not think the time was ripe for altering that principle in the slightest degree. It was proved that an association of professional men only could exist. They were not going to die out or be absorbed; and if they gave this matter their consideration—and he spoke with no uncertain voice—so that the members of the Gas Institute might be made fully aware of their intentions, it would tend to bring about at an early date the re-union which was so much desired.

Mr. GEORGE LIVESEY moved the following resolution, which he believed had been unanimously adopted by the Council of the Institution that morning: "That the members of the Institution of Gas Engineers approve of the action of the Council during the negotiations for amalgamation with the Gas Institute, and much regret their inability to accept the proposals of the Council of the Gas Institute, as contained in their letter dated Feb. 26, 1901." He said the importance of the gas industry was the question of first consideration with all the members. That it was an important industry, there could be no question whatever. It had existed for a hundred years, and the figures given showed that its vitality now was as great as, or even greater than, ever. These figures showed that the quantity of coal carbonized had risen from a total of 10 million tons in 1890 to 14 millions in 1900—an increase of 4 millions in ten years. This spoke volumes for the vitality of the gas industry; and not only its vitality, but its absolute necessity to the community. In 1889 he went to the Chief Commissioner of Police in connection with obtaining some assistance in consequence of the strike at his works. The Chief Commissioner said: "The stoppage of the work at the docks [where a strike had been going on] was not a public danger. But the stoppage of your works is a matter that involves the public safety; so that I can promise you I will do everything to assist you, within the law, that lies in my power." The authorities recognized the importance of the gas industry; and they, as gas makers (servants of the public) had a great duty to perform. He therefore considered that the chief thing to be done was to place the industry in the most efficient position possible. The necessity was that they should be united. There were two bodies representing the profession, and individually they were mostly personal friends. But they could not speak with the force and power that they ought to be able to do in order to enlist the public ear. One read of other institutions which were regularly reported in the newspapers; but the most meagre notices were given of the meetings of the Gas Institute and the Institution of Gas Engineers. It was therefore an absolute necessity that they should speak with a united voice, and command the respect which they deserved as servants of the public. This was not a question on behalf of either the Gas Institute or the Institution. Their only reason for existence was to promote the welfare of the gas industry. Therefore any personal or petty interest would have to give way to the general interest which they represented. There was no doubt the Institution was unanimous last year; and the Gas Institute also, he believed, regarded amalgamation as a necessity—at any rate, the great bulk of the members of that body so regarded it. As to the name which was most suitable for a united body, so far as he was concerned, he cared nothing, except that the very best name should be selected to express the objects and purposes of the Association; and he did not think the Council of the Institution would stand out about a mere name. The other question was that which concerned dissolution; and that, he believed, was an absolute necessity. He had with him the record of the proceedings of the Gas Institute last year; and their own Solicitor then said that, "under the Articles of the Institution, they had, as a matter of fact and law, no power whatever to amalgamate, except by going into liquidation;" and that "both Societies must liquidate in order to carry out amalgamation." Therefore dissolution was absolutely necessary. Much as they valued a union, and were impressed with the importance of presenting a united front, in order to promote the interest of their business, it was impossible that they could accept the suggestion that they should simply be absorbed. As to the name, speaking now for himself, he was free to confess that the title "Gas Institute" seemed to him about the best they could select. On the question of the admission of traders, there was no parallel between the Institution of Civil Engineers and the Gas Associations. One was a body selected for personal qualifications only, and not as representatives of any special industry. They had not the buying and selling of the articles used in the business of their employers, but the members of the Gas Associations were the representatives of the gas industry, and were responsible advisers and managers of gas undertakings all over the kingdom. They had the largest responsibility in the buying and selling of all the articles used by gas companies. Therefore their relations with the traders ought to be likened to the position of Cæsar's wife—they ought to be "above suspicion." There should be no connection with traders which would in the slightest degree allow any suspicion that they were actuated by motives other than the best and the highest. The system by which traders were admitted was one which must inevitably lead to what had taken place in the Gas Institute. Given the admission of a large body of traders to an Institution like this, they were forced, so to speak, in self-defence, to protect and promote their own interests. One man might go to a meeting and adopt a friendly tone towards the members—perfectly legitimately and properly; while another might think, "Well, this man is cutting me out, and I must do something to protect my interests." So the matter might grow until at last there would happen the circumstances

that occurred a few years ago, and to which he would not allude further. Two years ago, he was present at a meeting of the Gas Institute where a very strong feeling was expressed in favour of the union of the two bodies. But in the lobby he found the traders very busy. The principals of certain trading firms were all present, buzzing about like a number of bees. Now, he did not blame these gentlemen; but he did blame the system which, so to speak, compelled them to attend to protect, or look after, their interests. Coming now to the resolution which was passed by the Institute, he did not like to use strong words, but he really felt that there was one word only which expressed what he thought, and that was that the offering of such a resolution to the Institution was insulting. It really assumed that the Institution was composed of a body of men who had no self-respect. They were asked to abandon the principles that were dear to all of them not at the dictation of the members of the Gas Institute, but perhaps at the dictation of one or two men connected with it. He thought he knew who the prime-mover was; but it was best to avoid mentioning names. The prime-mover was elected last year to serve on the Council of the Gas Institute, and he said that, as he was now a member of the Council, his efforts would be put forth in that direction, and he would do all in his power to bring about an amalgamation. The one who had said this was, he felt quite sure, the prime-mover of the resolution; and if that was his way of bringing about an amalgamation, he would fail in his attempt. He (Mr. Livesey) should be very sorry to regard the whole of the members of the Council of the Institute as responsible for sending such a resolution as that which Mr. Helps had read. Now as to the way out of the difficulty. Last year the names of Messrs. West and Hepworth were freely used at the meeting of the Institute; and it was no doubt exceedingly distasteful to them to have their names brought forward as if they were the obstacles. Now, there was not the slightest objection to such gentlemen as Messrs. West and Hepworth being members of their Institution. Besides being traders, they had also rendered great service to the gas industry; and his (Mr. Livesey's) suggestion would be, not that there should be any bargain as to their being elected, but that there should be some honorary distinction given to all who had rendered good service. In the early days of the British Association of Gas Managers, Mr. Sugg and Mr. Hartley both rendered great service to the Association; and, after a number of years, it was resolved that they should be elected as honorary members. Neither would join as members. Though traders were admitted, they said their position was such that they would not care to become members. They were, however, ultimately elected honorary members. Why should they not elect all the Past-Presidents as honorary members, and any men of eminence who had rendered service to the gas industry, whoever they might be, whether traders or not, whom the Council might recommend, and the members approve. At any rate, he thought he might say, for the Institution, that they were willing to agree to any reasonable or honourable method whereby the union could be effected.

Mr. W. King (Liverpool), in seconding the motion, said he could not refrain from expressing his personal disappointment at the failure of the negotiations. There was certainly a disposition on the part of the Institution to meet the Gas Institute in the frankest and fairest manner; and he thought he was only expressing the opinion of the members present when he said that they had entertained the hope from the earliest steps of the negotiations that there was every prospect of bringing about that most desirable result, the consolidation of the representatives of the gas industry into one fully representative and strong body. Their thanks were greatly due to their late President (Mr. Helps) and his colleagues, for the attention that they had given to the matter. The ordinary members of the Institution, he thought, had perhaps not fully realized the amount of anxiety that the negotiations had caused to the gentlemen to whom they had entrusted their interests. Some idea of their devotion could be formed from the report and the correspondence attached to it; and considering the action taken by the Gas Institute, he feared that at present there was no other course open for the Institution than to affirm the action taken by the Council, and support them thoroughly. The suggestions now thrown out by the Gas Institute could not be entertained; and he was afraid they had drifted entirely apart from the principles laid down and adopted at the last annual meeting. On those they had taken their stand; and they could not depart from them.

Mr. F. W. Cross (Lea Bridge) referred specially to the letter which Mr. Helps read, addressed from himself to Mr. Marshall, and pointed out the three classes of membership suggested by Mr. Stevenson. The third paragraph, referring to the third of the classes, stated: "Honorary members to consist of those who have made themselves eminent in scientific pursuits connected with the gas industry." This was nearly word for word according to Mr. Livesey's suggestion. He asked whether this particular class was embodied in the rules laid before them last year.

Mr. Carpenter replied in the affirmative.

Mr. Cross said in that case he considered the Institution had offered all they possibly could offer to the other side. This covered the whole question of traders so far as they were now concerned; and they could not possibly go back upon what the Council had done. For the Institute to bring forward the proposition they had included in their February letter—that they should be absorbed—was absolutely absurd. He agreed that the resolution now before the Institution should be supported.

Mr. R. O. Paterson (Cheltenham) asked whether there was no way left open for further negotiations. Was it the desire and wish of the Council that all further negotiations should be brought to an end by this resolution? Of course, the members were not desirous of going in the face of the proceedings of the Council.

Mr. Livesey said he regretted that it was felt to be impossible for the Institution to do anything further. It was for the other people to communicate now.

Mr. Paterson said he thought it a pity they should place themselves in such a position; and he suggested that a few words added to the present resolution, referring to a continuance of the negotiations with the Council of the Gas Institute, would not be very humiliating, and might be the means of still leaving the door open.

Mr. Livesey: Will you suggest the words?

Mr. Paterson said that was a difficult thing to do. (Laughter.) Still, it seemed that the resolution, as read out, could have attached to it a few words something like this: "But they propose to continue negotiations on the subject."

The President: I do not see how we can continue.

Mr. Paterson remarked that he did not desire to press the matter; but he wanted to point out that the resolution appeared to lay the negotiations aside for good and all.

Mr. Livesey said the Institution were open to receive a communication from the Institute.

Mr. Paterson said, of course, the Gas Institute must be acknowledged in this matter. They were the parent body; and it could hardly be expected that the parent body ought to first approach a naughty child. (Cries of "Oh!") He really thought negotiations should proceed, though he would not press his point.

The President observed that they were quite prepared to continue the negotiations on the lines originally laid down. On receipt of any communication from the Institute, founded on those principles, the Council would think it was perfectly right to continue negotiations.

Mr. Robert Morton thought that the majority were desirous that negotiations should not be broken off, and that something might be added to the resolution. The reason that what the Institute had last recommended could not be accepted now was because the recommendation was on a different basis to what it formerly was. Last year the union was decided upon; and the Institute were departing from that altogether. If something were added, as had been suggested, it would encourage those in the Gas Institute who were still desirous to amalgamate.

Mr. C. Meiklejohn (Rugby) said that to him it appeared that the question of amalgamation did not crop up at all in the letter of February from the Institute. There was no question of amalgamation, and nothing to discuss. In that letter, the question was closed; and there appeared no possibility of negotiations being reopened until the letter was withdrawn.

Mr. S. Y. Shoubridge (Lower Sydenham) expressed his great regret that the Council of the Institute, after the negotiations that had taken place, should have thought fit to address such a letter as that to the Institution. He, for one, could not help feeling exactly as Mr. Livesey had so well expressed—that it was an insult; and he was of opinion that they should not alter the resolution, but should leave any further proposal to emanate from the Institute. They could not, with any self-respect, make further overtures. He felt that the action of the Council of the Institute would

not be supported by the members, when the matter was submitted to them; for he thought that the vast majority of the members were anxious for an amalgamation, and would regret, as much as he himself did, the unfortunate action of the Council.

Mr. W. Doig Gibb (Newcastle-on-Tyne) considered the whole matter lay in a nutshell. The letter was such as must leave the Institution no option but to accept the resolution of Mr. Livesey. At a recent meeting of the North of England Association, the opinion of the members was taken; and he did not think that the Institute as a body would endorse the letter.

Mr. Paterson said that seemed to him all the more reason why they should make the addition to the resolution which had been suggested, and not close the door entirely.

Mr. Livesey: The door is open for them.

Mr. F. W. Stevenson (London) contended that the resolution did somewhat close the door; and he hoped that some words would be added to show they were still willing to continue negotiations, on the lines originally laid down and agreed to by the Joint Committee of the two Councils of the Institute and Institution. He did not think they ought to close the door, especially as the majority of the members of the Institute would not support their Council. It must be remembered that the members threw over their Council last year; and they might do the same again this year.

Mr. T. Berridge (Leamington) said he was a member of both bodies, and quite agreed with Mr. Paterson and Mr. Stevenson. He was another who did not think the members of the Institute would support their Council. One way to get amalgamation would be for the Institution to reduce its fees, when it would grow as the Institute grew. While the former was standing still, the latter was growing rapidly. He was also of opinion that the exclusion of small managers would stop amalgamation.

Mr. C. E. Botley (Hastings) quite agreed that the door should not be shut. However, the terms referred to were made before the meeting last year, and unanimously adopted; and if the Institute wished to continue the negotiations, they could go on. But in face of what they had now done, he failed to see how the Institution could move in the matter.

Mr. S. Meunier (Stockport) said he was quite at one with Mr. Paterson and Mr. Stevenson, and would not like to see the door closed. If the present resolution was altered, it might tend to lower the dignity of the Council; but he certainly thought there should be some sort of instruction or official intimation outside the resolution itself, to the effect that they were perfectly prepared to go on with negotiations on similar lines to those agreed to last year. As to the name, he thought "Gas Institute" was as good as they could get. But this was a minor point; and it would be undignified to risk the loss of amalgamation through that. With regard to the admission of the trader, he saw no reason why the united wisdom of the two Councils should not get over this point. The main difficulty which he foresaw was as to the dissolution. He did not like the idea of the Institution being "absorbed;" and the suggestion did not show that they were being treated with due respect. Although he was anxious for a united body, he thought they should stand on their dignity; but, at the same time, it might be in some way conveyed to the Council and members of the Institute that the door was still left open, and the Institution were willing to meet them half-way and resume negotiations, if they showed the slightest wish for it. Perhaps the resolution might be somewhat modified; for it seemed to him to say: "We have done all we can. If you like to come along, we will meet you; but we will not move a foot further than we have done." As Mr. Paterson said, the Institute was the older body. Probably they had more sentiment than the Institution; and perhaps they were entitled to have it. If the Institution let them see they were willing to move directly they did, and on the same basis as last year, this would enable them to go on.

Mr. E. A. Harman (Huddersfield) said their minds were perfectly made up on the matter. Every reasonable facility had been offered the Institute; and the terms had not been accepted. The time had come when the dignity of those present was concerned; and they really must stand upon it. Things had come to such a pass that they ought to carry the resolution as moved by Mr. Livesey, without any addition being made to it.

Mr. T. Banbury Ball (Rochdale) was not at all of Mr. Harman's opinion. There was a far greater question than either dignity or pride—there was a question of principle. Upon this he was prepared to stand. Last year it was very definitely decided what the principle was upon which they were to amalgamate; and the question now was: Are the members prepared to depart from it? (Cries of "No.") Up to a recent date, negotiations had been conducted with that principle in view; and he thought it simply trifling with the matter now to ask the Institution to start on an altogether new basis. They themselves had shown no disposition to stand upon trifles—not even as to the name, perhaps. But on the point which was embraced by the correspondence of February, the members ought now to give a decided opinion, and say that they could not possibly entertain the proposition of the Institute.

Mr. J. F. Bell (Derby) thought an expression should go forth to the effect that they regretted the negotiations had terminated. If not, then it would be found that the door was quite closed. It would certainly be to the advantage of the gas industry if the two Societies were amalgamated. It seemed a great pity that negotiations extending over two years should be abruptly stopped.

The President reminded the members that the resolution distinctly referred to the letter of Feb. 26, and did not at all shut the door to negotiations. While the Council were quite impartial in the matter of adding a phrase to the resolution, he did not think it was requisite. The letter referred to contained a different set of propositions to what were agreed upon last year. The expression of opinion given to-day would be quite sufficient to show the Council and members of the Institute that the door was still open wide. The Institution felt, however, that a great deal of time had been taken up, and expense incurred; and then at the eleventh hour a different set of propositions and bases of amalgamation were brought before them. This he could not but feel was playing with the question, rather than handling it seriously.

Mr. Livesey remarked that there was no question whatever that they were ready to renew the negotiations for amalgamation; but the resolution dealt with the last letter received—that of Feb. 26—and this settled the matter. It was for the Institute now to send any proposals. He agreed with Mr. Paterson and Mr. Stevenson; but he did not see how they could add to the resolution.

Mr. Paterson thought that, after the discussion which had taken place, their object would be attained.

Mr. Helps said that, as the drawer up of the report, he had every sympathy with the remarks made by Mr. Paterson and others, who thought an addition ought to be made to the resolution. On the other hand, he failed to see the necessity for it. If the members of the Institute read this discussion in the papers, they must see that every member who had spoken and was present to-day, was particularly anxious that the door should not be shut against further negotiations. Moreover, he did not think the resolution as now framed showed any desire to shut it. If it was now closed, then he maintained it was closed by the letter of the Institute, and should be opened again by the writers of it. Therefore he thought the resolution should remain as originally framed.

The resolution was then put and carried unanimously, amid loud applause.

In the course of the day, the Secretary of the Institution (Mr. Cole) was instructed by the Council to communicate to the Gas Institute the result of the discussion; and we have received from Mr. Dunn, for publication, a copy of the letter addressed by him to the Institution last Saturday in reply thereto. It is as follows:—

13, *Victoria Street, S.W., May* 4, 1901.

Thomas Cole, Esq.,
Secretary, Incorporated Institution of Gas Engineers.

Dear Sir,—In reply to your letter of the 1st inst., which has had the careful consideration of my Council at their meeting to-day, I am instructed to say they consider that, in presenting the report on the amalgamation scheme to your members, the matter was not made sufficiently complete to enable them to give a clear vote upon the issue, more especially with regard to the joint conference of the two Councils which took place on the 9th of February last. The principal point submitted at that conference was the retention or otherwise of the extraordinary members and associates now on the roll of the Gas Institute; this being the main point at issue between the two bodies.

You will remember that my Council pointed out how difficult it was to make any invidious selection of those

who might be retained—a difficulty which your members quite admitted; and my Council suggested that a much fairer and better method would be for your Institution to accept the present roll of the Institute members as it stands, and that in course of time the class of member referred to above would soon be deleted by natural process, from the fact of there having been no elections to it since the year 1897.

It is quite true that two other questions were mentioned at the conference—(1) the name of the Institute, and (2) dissolution of the two bodies prior to amalgamation. My Council were asked to express an opinion upon these points, which they did; and such opinion they still hold. As to the first question, they believe there can be no better or simpler name than "The Gas Institute;" and with reference to the second, they consider that if some other means than dissolution could be adopted, considerable expense would be avoided. They do not, however, desire (and they thought they had made this view very plain to your Council) that these two points should stand in the way of amalgamation; and rather than that should be the case, they would be willing to give way upon both of them if your Council would concede what the Council of the Institute consider to be the only real point at issue—viz., the retention of the names at present on its roll.

My Council now are, and always have been, sincerely desirous of amalgamation; and to bring it about, are willing to make some sacrifice, and offer to concede the two points of name and dissolution if your Council can see their way to adopting the retention of all the members of the Institute.

They would like some expression of opinion from your Council as to whether they are prepared to accept such proposals; and, if not, would be glad to know what other proposals your Council have to make on the matter.

I have to add that I am instructed to send a copy of this letter to the Press, in order that no misunderstanding shall arise as to what has been the intention of my Council.

(Signed) WALTER T. DUNN, Secretary.

READING OF PAPERS.

In the afternoon, the reading of papers was commenced. They were taken in the following order:—

Wednesday.—(1) "Notes on Water-Gas Manufacture." By THOMAS HOLGATE, F.C.S., M.Inst.C.E. (2) "Purification, and Methods of Working Purifiers." By B. W. SMITH.

Thursday.—(3) "Some Differences between British and Continental Gas Engineering." By C. E. BRACKENBURY, Assoc.M.Inst.C.E. (4) "Some Notes on the Conditions which Prevail within a Carburetted Water-Gas Plant." By W. J. ATKINSON BUTTERFIELD, M.A., F.I.C. (5) "The Progressive Age." By J. D. ASHWORTH.

The papers by Mr. Holgate and Mr. Smith, with the discussions thereon, will be found in another part of the "JOURNAL." The rest will be given next week.

At the close of the discussions on Thursday afternoon, the general business was resumed.

APPOINTMENT OF SCRUTINEERS.

The PRESIDENT said the three present Scrutineers were Messrs. Broadberry, Iago, and W. E. Price. As Mr. Broadberry had been elected a member of the Council, he would suggest that Mr. Guyatt should be appointed in his place.

This was at once agreed to.

THE AUTUMN MEETING.

The PRESIDENT said the International Engineering Congress would be held in Glasgow, commencing on the 3rd of September; and he would therefore propose that the autumn meeting of the Institution be held in Edinburgh on the 2nd of that month. The new works at Granton would by that time be in such a condition that a day might be very pleasantly spent there; and there would also be a reception or garden party in the grounds of his own house, which was not far off.

Mr. HOLGATE seconded the motion, and it was carried unanimously.

Mr. J. W. HELPS, as Secretary of the Gas Section of the Congress, said he had been informed by the General Secretary that it was absolutely necessary for those who wished to attend to send in their names at once, as there was some difficulty in finding accommodation. He understood that already some 2000 gentlemen had responded, so that it was going to be a very big affair; and he hoped all members of the Institution would comply with his request as soon as possible, as it would be "first come, first served." Although he was Secretary of the Gas Section, he had only addressed circulars to members of the Institution, and had suggested to Mr. Dunn to send them to the members of the Gas Institute, with the postcards for reply; but he regretted to say that as yet this had not been done. The matter was being warmly taken up by their brethren on the Continent; and he had already several promises of papers, both from England and abroad. He could assure them the Congress would be quite as successful as the one held in Paris last year; and he hoped everyone would do his utmost to secure that the Gas Section was in no way behind the others. With the annual autumn meeting of which the President had just given notice, he thought they would have an opportunity next September of enjoying a week which would remain long in their memories.

Mr. F. W. CROSS (Lea Bridge) asked if it would be possible to arrange for a "gas colony" in Glasgow.

Mr. HELPS said this would have to be left to the Reception Committee in Glasgow. It had been suggested that a number of houses should be taken, as they had only been able to secure about 300 bedrooms at the hotels; and something of that kind must be done.

VOTES OF THANKS.

The PRESIDENT then moved—"That the best thanks of the meeting be given to the President and Council of the Institution of Civil Engineers, for their kindness in granting the use of the rooms of the Institution for the purpose of the meeting." He said it was a privilege which they all highly appreciated.

Mr. W. NORTH (Stourbridge) seconded the motion, which was carried unanimously.

On the motion of the PRESIDENT, seconded by Mr. S. GLOVER, a vote of thanks was accorded to the authors of the papers.

The PRESIDENT moved that a vote of thanks be given to the Honorary Auditor, Mr. Magnus Ohren, who, he was sorry to say, had not been able to attend the meeting, but nevertheless had discharged his duties most efficiently.

Mr. D. H. HELPS (Redhill) seconded the motion, which was carried unanimously.

Mr. A. F. BROWNE (Vauxhall) moved that the best thanks of the meeting be given to the Council of the Institution for their management of its affairs during the past year. The labours of the Council were always considerable, and during the year they had been greatly increased in connection with the visit to the International Gas Congress in Paris. They had to thank them for the arrangements they made to support the dignity of the Institution and secure the comfort of the members; also, and particularly, for the manner in which they had conducted the delicate and difficult negotiations in regard to a reunion of the two Societies, in which they had shown tact, temper, and loyalty to the best interests of both. This time last year the prospect seemed bright; then it again became cloudy; and at present it seemed darker than ever. He could only hope that it was the darkest hour which preceded the dawn. At any rate, they were proud to think that there was nothing in the whole conduct of the negotiations which they could have wished altered.

Mr. BEYNON (Torquay) seconded the motion, which was carried unanimously.

Mr. W. DOIG GIBB (Newcastle) moved that the best thanks of the meeting be given to the President for his conduct in the chair. It was very difficult to succeed a good President; and Mr. Helps had proved himself so popular and hard working, that no greater praise could be given to Mr. Herring than to say he was a worthy successor. He (Mr. Gibb) was quite sure that if the dawn to which Mr. Browne had alluded should come during his presidency, he would take the fullest advantage of it.

Mr. HOLGATE seconded the motion; and it was carried by acclamation.

The PRESIDENT, in responding, thanked the members for the kind support they had given him, and expressed the hope that he should not let down the dignity which the Institution had attained under his predecessors.

Mr. HELPS moved a vote of thanks to Mr. Cole, the Secretary, for the able manner in which he had carried out

his duties. During his own term of office, he had had ample opportunities of judging of his affability, and his capacity for hard work.

The PRESIDENT seconded the motion, which was carried unanimously.

Mr. COLE having very briefly responded, the proceedings terminated.

PAPERS READ.

NOTES ON WATER-GAS MANUFACTURE.

By THOS. HOLGATE, F.C.S., M.Inst.C.E., of Halifax.

In presenting this compilation of notes and thoughts, the author feels he must explain that its incompleteness is due to the short time for its preparation. He would much rather have listened to a comprehensive review of the subject from one who had more experience; but that not being possible, the only alternative is to lay before you what his own investigations have recently suggested. He must at the outset express his indebtedness to many of his professional brethren who have placed their works, their results, and their experience at his service. In this way, he has been able to compare water-gas manufacture under diverse conditions—the facts relating to which may be helpful when collated, and the essential features emphasized. The simplicity of the process in some aspects is undoubted; but in others uncertainty exists to such an extent as to call for further elucidation. Towards this end, it is hoped that a full and frank discussion will take place.

At present prices of oil, it may be doubted whether many gas works can show a lower cost for carburetted water gas than for coal gas—as was possible a few years ago. The continuance of high-priced oils has brought into prominence the secondary advantages of carburetted water gas.

Having recognized these secondaries, it is desirable not to allow them to obscure the main issue—viz., to obtain the most suitable gas at the lowest cost. We shall be all the more sure of the secondary if we secure the primary. Towards this end it behoves the gas engineer to examine carefully every project for improved results; and there are now two types to hand for his consideration: (*a*) Where generators are designed to work with a hot carburettor supplied with oil (*e.g.*, Lowe). (*b*) Where the generator is designed to produce water gas only. To this latter class belong the Dellwik, now introduced into English gas-works at West Bromwich (Mr. Thomas Glover, Engineer), and the Strache, used on the Continent in many small works. The former usually combines benzol enrichment (in the cold); while the latter is frequently employed without any addition beyond carbylamine—used to impart an odour.

The distinctive features of the Dellwik system appear to be the regulation of the blast of air, in its volume and velocity, to the proper sectional area and depth of fuel; the aim being to produce during the blow the highest temperature in the fuel, consistent with the absence of carbonic oxide in the exit gases. The combustion of 12 parts of carbon into carbonic oxide yields 29,000 units of heat, but into carbonic acid, 97,000 units Centigrade. It is manifestly desirable, therefore, to reduce the production of carbonic oxide during the blow—or inversely what is desired during the blow. However, when the high temperature has been secured during the blow, if the operation is continued, then that high temperature produces carbonic oxide.

The author understands that about 4 feet is the depth of fuel that has been found to give the best results; and this is maintained as uniformly as possible by supplying coke at about every third run. The blast of air is usually given by a Roots blower, which has the advantage of being positive in its action. No matter whether the grate is partially obstructed by clinker, or whether the fuel is compact or open, the definite quantity of air required can be delivered.

In the case investigated by the author, the blow was for 1¾ minutes; and the following are the analyses of the gases:—

Blow Gases from Generator (Dellwik System).

Component.	First Half Minute.	Last Half Minute.	Remarks.
O	trace	nil	Large coke used, 8 in. × 6 in.
CO_2	10·0	11·0	× 6 in. Depth of fuel,
N (by difference)	76·8	81·4	4 feet. Air pressure,
CO	13·2	7·6	12 inches.

The percentage of carbonic oxide and the sensible heat wasted up the chimney leave something to be desired; but the approach to a well-defined operation is instructive.

The temperature in the generator being sufficiently high, the air is shut off, and steam is admitted. As shown by the figures given below, the quality of the water gas is at first good; but towards the end of the run it cannot be regarded as satisfactory, except (say) for use in an iron-works. The flow of steam is slow, and with such a comparatively thin bed of fuel a higher speed would give so much more carbonic acid as to be unsatisfactory.

The two elements desired in the run are mass of fuel and high temperature. The latter appears to have been well provided, but somewhat at the expense of the former. The net result, however, must be better than when the precautions mentioned have been ignored.

Analyses of Gas from Generator (Dellwik System) during Run of 11 Minutes.

[Nine samples taken at equal intervals. Depth of fuel, 4 feet; make per hour, 15,000 cubic feet; steam pressure, 120 lbs.]

Component.	No. 1.	2.	3.	4.	5.	6.	7.	8.	9.	Aver.
H_2S	0·2	0·20	0·2	0·40	0·40	0·60	1·00	1·20	1·20	0·60
CO_2	0·4	0·60	0·8	1·00	2·00	2·90	6·40	9·80	14·10	4·22
N	2·0	3·81	2·3	2·94	1·63	2·63	2·20	3·71	4·39	2·85
CO	46·4	46·00	44·8	45·20	44·10	42·40	36·60	29·00	22·10	39·62
H	50·2	48·70	51·1	49·75	51·01	50·70	52·96	55·06	57·80	51·92
CH_4	0·8	0·69	0·8	0·71	0·86	0·77	0·74	1·23	0·41	0·78
Total combustibles	97·4	95·39	96·7	95·66	95·97	93·87	90·30	85·29	80·31	92·32

The purified blue water gas is stated by Mr. Dellwik to be 70,000 to 72,000 cubic feet per ton of carbon used in the generator. The boiler fuel would be 15 to 20 per cent. that of the generator. He also states that at Erfurt an admixture of 25 per cent. of water gas to the coal gas reduces the candle power from 18 to 14 candles. To bring the candle power of the mixture up to 18 candles, benzol is added, ½ gallon per 1000 cubic feet of blue gas. These results are obtained by mixing the water gas with the coal gas in the hydraulic main; the former absorbing benzol from the tar. When this is not done, as at Königsberg, the consumption of benzol is 0·7 gallon.

—	Mr. Dellwik's Estimate of Working Expenses.	The Author's Alternate Estimate (including Boiler Fuel).
	d.	d.
34 lbs. of coke, at 11s. per ton	2·60	2·40
Labour	0·90	1·20
Purifying (lime and wages)	0·25	1·25
Repairs, salaries, &c.	..	0·75
Water, oil, and sundries	0·15	0·40
	3·30	6·00

Cost of Mixture (4 Coal Gas, 1 Water Gas).

—	Mr. Dellwik's Estimate.	Author's Alternative Estimate.
	d.	d.
4000 cubic feet of coal gas at 11d.	44·00	44·00
1000 cubic feet of blue water gas.	3·30	6·00
0·7 gallon of benzol, at 10d.	7·00	8·50
5000 cubic feet of 18-candle gas.	54·30	58·50
Or per 1000 cubic feet.	10·86	11·70

Which of the above estimates will be most nearly realized must depend upon the price of benzol, and upon the many other factors affecting the relative cost of coal gas and blue water gas in capital and working expenses. Where lime is used to remove 3 to 4 per cent. of carbonic acid, the cost of purification will be much nearer the alternative estimate.

The percentage of carbonic oxide in the mixed gas, benzolized or otherwise, would be greater than with mixed coal gas and carburetted water gas. The calorific power of the mixture would be less than when carburetted water gas is used; but while this would be advantageous in an incandescent burner (as shown by Dr. Strache), it would be a disadvantage in heating and motive power. If the benzolizing were omitted, then the reduced cost would fully compensate for the reduced heating power.

The following tests were made upon the Halifax generator to determine in what way the results were affected by reducing the thickness of the fuel bed:—

Tests on Halifax Generator.

[Depth of fuel, 5 ft. 9 in. Samples taken at 2.40 p.m. Generator clinkered at 11 a.m. Coked at 11 a.m., 28 cwt.; at 12.20 p.m., 14 cwt.; at 1.10 p.m., 14 cwt.; and at 2.25 p.m., 14 cwt. Pressure of steam, 130 lbs. and superheated. Make per hour, 46,500 cubic feet; per run, 7170 feet.]

Component.	1st Min.	3rd Min.	5th Min.	6½ Min.	Average.
H_2S	0·60	0·40	0·60	0·44	0·51
CO_2	0·42	1·60	2·40	6·20	2·65
N	2·18	1·75	2·94	1·42	2·07
CO	46·70	43·80	42·00	41·30	43·45
H	49·40	51·70	51·30	49·70	50·52
CH_4	0·67	0·75	0·76	0·94	0·78
Total combustibles .	96·77	96·25	94·06	91·94	94·75

[Samples taken at 4 p.m. Depth of fuel, 4 ft. 1 in. Particulars of clinkering and coking as above. Sample taken 1½ hours after coking. Pressure of steam, 125 lbs. and superheated. Make per hour, 45,000 cubic feet; per run, 6923 cubic feet.]

Component.	1st Min.	3rd Min.	5th Min.	6½ Min.	Average.
H_2S	0·91	0·90	0·91	0·80	0·88
CO_2	2·80	3·40	6·20	9·40	5·45
N	2·55	2·70	1·70	2·11	2·26
CO	46·60	44·70	38·80	33·00	40·77
H	46·30	47·40	51·60	53·80	49·78
CH_4	0·84	0·90	0·84	0·89	0·87
Total combustibles .	93·74	93·00	91·24	87·69	91·42

Note.—Make of gas from 11.15 a.m. to 7.45 p.m., 384,000 cubic feet = 6857 cubic feet per run, or 44,393 cubic feet per hour. Average, 32·6 lbs. of coke and 3·5 gallons of oil per 1000 cubic feet of gas.

Dr. H. Strache's system has been adopted in a good many towns on the Continent; and additional interest is aroused by his excellent contribution recently published in the "JOURNAL OF GAS LIGHTING." Strache summarizes the results of his very extensive experiments as follows:—

Briefly, they show that, in the first place, the direct combustion of carbon to carbonic acid is attained, not by a high pressure of air-blast and small depth of fuel, but by adherence to a low temperature. The result is not novel, but is familiar to every engineer, who knows that, on lighting up any generator, as long as the charge of fuel has a low temperature, carbonic acid is produced; and carbonic oxide only after the temperature has risen. There is consequently nothing simpler—disregarding the pressure of air and the depth of fuel—than to interrupt the blow in a water-gas generator as soon as carbonic oxide appears in the effluent gases. Bunte has proved that the extent to which the steam is decomposed is chiefly affected by the temperature; but he did not have occasion to take account of the rate of flow of the steam. These researches (Strache's) supplement Bunte's, and show that the decomposition of the steam is influenced, not merely by the temperature, but to a considerable extent by the rate of its flow; and that by the relatively low temperatures which are attained with a "blow" of one to two minutes' duration, a tolerably complete decomposition of the steam occurs, provided the rate of flow is proportioned accordingly. The losses by incomplete combustion during the blows can be avoided or diminished either by burning the carbonic oxide which is obtained to carbonic acid in a regenerator, in which the heat thus liberated is employed to pre-heat the air for the blast or the steam, or by efforts to secure complete combustion to carbonic acid in the generator. The first method has been adopted by Strache; the second may be carried out by adopting the principles indicated above—viz., short blows (entailing low temperature) and low velocity of the steam.

It may be remarked that these are truisms that were well known before they were so clearly expressed. If so, then the thanks of the profession are due to Drs. Strache and Jahoda for their experimental proofs and analyses.

According to Strache* the coke required in his apparatus per cubic metre of water gas is given; and the figures are valuable as showing the direction in which economy of production of water gas may be found—

Temperature of Air in Degrees Centigrade.	Temperature of Steam in Degrees Centigrade.			
	100	500	1000	1500
1	2·03	1·84	1·49	1·01
500	1·13	1·04	0·88	0·64
1000	0·85	0·79	0·68	0·53

The author is aware that extravagant claims have been put forward as to the value of superheated steam for water-gas manufacture; but this need not deter a rational investigation of the case. The problem may be stated as follows: The decomposition of steam in contact with incandescent carbon, requires a large quantity of heat; and it requires not less than a specific temperature—say, 800° C. The minimum temperature of the carbon may be employed, but prolonged contact will be necessary; and therefore, in practice, a margin above the minimum must be adopted. The quantity of heat that can conveniently be admitted in the steam is but a fraction of that required for the reaction; but the temperature of the steam which will determine the speed of that reaction is an important factor.

The advantages to be gained by pre-heating the air may be stated as follows: (1) A lesser weight will be required to raise the coke to its proper temperature; and consequently a smaller quantity of the useless nitrogen will require to be heated to the fuel temperatures. As the air would be pre-heated by the exit gases, the heat units taken in by the air would represent the direct saving; but the shortening of the time of blow would diminish the loss from incomplete combustion of carbon to monoxide. A lesser quantity of carbon monoxide would be required in the carburettor and fixing chamber, because of the increased temperature of the secondary air. (2) The fuel would be more perfectly consumed than at present, and less time required or fuel wasted in clinkering. (3) The higher temperature of air and steam would render unnecessary the reversal of the flow of the same through the generator.

The general effect upon the process would be to diminish the length of time occupied in blowing, and increase the periods of running with a higher speed of steam through the generator, while maintaining the desired percentage of carbonic acid in the water gas.

As steam under pressure is not required, there is no reason why exhaust steam should not be superheated, and thus largely reduce the labour and fuel at the boilers.

The net result would be that (employing only moderate temperatures for pre-heating) the capital outlay per million cubic feet per diem would not be increased; so that the production of water gas would be conducted with an economy in labour and fuel at present unknown. In other words, no matter whether the Dellwik or Lowe type of generator be used, marked economy would accrue by saving the heat in the way described.

The author will now refer to the experience he has had with superheated steam. At the Halifax Gas-Works the boilers are fitted with Musgrave's superheaters; and the steam for the various engines and the water-gas plant is, therefore, delivered dry, and at a temperature of about 480° Fahr. The result of this has been to extend the runs from 5 to 6½ minutes, coupled with a low percentage of carbonic acid in the gas. When using steam of the temperature 480° Fahr., the average of several samples of the gas taken every minute of the run was 1·23; and when using steam of 280° Fahr., it was 1·73—a difference of 40 per cent. The average of a good many tests taken at the end of each run, gave 3·44 for superheated, and 4·91 for non-superheated steam—an increase of 42 per cent.

For reference and for comparison with Dellwik's generator the following figures may be useful:—

Analysis of Gases from the Halifax Generator during Blows each of Three Minutes.

	2nd Min.	3rd Min.	2nd Min.	3rd Min.	2nd Min.	3rd Min.	Remarks.
CO_2	10·0	6·4	9·9	6·8	2·8	3·0	Generator clinkered at 6 a.m. and 5.30 p.m.; coked at 11.35 a.m., also at 2 55 p.m. and 5.40 p.m. Air blast 16 in.
O	nil	nil	nil	nil	nil	nil	
CO	13·0	21·0	16·1	20·8	20·2	20·2	
N, &c.	77·0	72·6	74·0	72·4	77·2	76·8	
	Samples taken at 12 a.m., fires clinkered at 6 a.m.		Samples taken at 3.45 p.m., fires clinkered at 6 a.m.		Samples taken at 6 p.m., after clinkering.		

It appears that, with a clear fire, the maximum quantity of carbonic oxide was attained at the end of the second minute; when clinkers had gathered, that maximum was attained at 2½ minutes.

In a discussion which took place at the International Gas Congress in Paris last year, Mr. A. G. Glasgow referred to an estimate of the efficiency of a carburetted water gas as "81 per cent. in commercial operation." On referring in detail to the figures given in Mr. Glasgow's original paper, I find facts I have summarized (see next page).

The percentage of ash or water contained in the anthracite is not stated. Bearing this in mind, and the fact that the efficiency of the boiler is not brought into this statement, it is quite evident that the heat efficiency is very far from being satisfactory. Mr. Glasgow's calculations, however, were extended to bring in the heat capable of being generated by the oil, and its relation to the heating power of the gas produced therefrom; and he found that 92 per cent. of the former reappeared as the latter. He took the efficiency of

* See "JOURNAL," Vol. LXXVI., p. 703.

Distribution of Energy per 1000 Cubic Feet of Unpurified Carburetted Water Gas.

Illuminating Power, 31 candles; 4·17 English gallons per 1000 cubic feet. The Water Gas was 64·5 per cent. of the Carburetted Water Gas.

—	Pounds.	Heat Units.
Gross generator fuel (anthracite)	33·400	..
Ash and unconsumed fuel recovered	9·900	..
A.—Total combustible (carbon)	23·500	340,750
B.—The energy of the CO produced	6·280	91,043
C.—The energy of the H produced	6·243	90,533
H.—The heat rendered latent in the gasification of the oil	0·812	11,776
Total energy utilized	13·335	193,352

the generator fuel as 61 per cent., and combining therewith the 92 per cent. before mentioned, obtained what is termed a "commercial efficiency" of 81 per cent. I think it is well to have these two sets of figures quite distinct; for instance, in the way usually done with an engine and boiler. The fact that you have an ideal steam-engine should not be used as a set-off against a bad boiler. The heat required to gasify the oil is clearly to be credited to the fuel in the generator; and when that has been done, the heat equation, as to oil used and recovered, should be separately stated, without being compounded with the former.

These figures of the heat utilized show at once that a very considerable margin exists for further improvement: 1. Out of 33·4 lbs. of fuel put into a generator, it should not be necessary to draw out 9·9 lbs., all of which has to be handled, and the greater part of which is not serviceable as fuel. 2. Of the 27,929 heat units, representing the difference between the sensible heat of the escaping illuminating gas and the entering oil, and of the 74,152 heat units carried off by the escaping blast products, a large percentage should be returned. 3. The figure given for the fuel consumption in these calculations is much below what is used in many plants, and in those the possibilities of economy would be greater—probably by facilities for maintaining uniformity of the coke bed, uniformity of blast and steam volumes, and greater uniformity of temperature in the carburettor and fixing chamber.

The governing factors in comparing the Dellwik and Lowe systems are, of course, the price of benzol and oil. The plant, therefore, that should give the best results would be one in which either enricher could be sparingly or liberally used; and, again in which the blue water gas could be diverted for admixture with the coal gas in the hydraulic main.

In Appendix A will be found a distillation and a gas-making test of blast-furnace oil, and in Appendix B analyses of gas made from Russian Solar distillate, together with particulars of the generator gases.

The capacity of water-gas plants appears to be rated in a somewhat indefinite manner—the actual and nominal production often being referred to as widely different. The one factor that pre-eminently gives the clue to correct working is the percentage of carbonic acid in the gas; and the author suggests as desirable that the capacity should be stated in cubic feet of gas containing no greater average than 2 per cent. of carbonic acid through the 24 hours. The efficiency of the blowing operations and of the steam decomposition are indexed by the carbonic acid; and as the cost of its removal by lime is an important one, its place in the cost-sheet is equally significant.

It must be advantageous to use hot coke; and at Halifax, as the water-gas plant is in one corner of the retort-house now being erected, the hot-coke conveyor is to bring unquenched coke over the mouths of the water-gas generators. If the feed cannot be made continuous, it is hoped it will be frequent. Where cold coke must of necessity be used, it appears that a copper fitted with two valves could be arranged for feeding without stopping gas-making. From replies to inquiries the author has made, he is led to believe that when other things are equal, then an increase of blast pressure effects an increased output and proportionate fuel economy. In some cases 24 inches is the pressure close to the fan. The essential feature in the air supply appears to be not the pressure, but the volume and temperature; and the same remarks apply to the steam.

The large-sized generators—say, for one million per day—entail much labour in removing clinker; and it is to be hoped that the continuous removal of clinker will be accomplished—perhaps by a water-sealed ashpit. Pending this attainment, relief may be perhaps secured by larger clinkering doors than at present.

The valve for securing up-and-down runs should be reliable; so that the waste of fuel from the bottom of the generator may be minimized. I should like to hear the experience of those who have worked for a time with valves, (*a*) water-cooled, (*b*) not water-cooled, so as to learn their respective merits. The form of coke buggy that appears to be the most convenient is the one made with a sliding bottom—leaving a clear opening for the coke, with less scattering of the same, and facility for adding small quantities of coke at a time by the gas-maker only.

Slow-speed engines, with countershaft bolted to the fan, seem to suit many small plants; but the installation in which an engine of the Belliss enclosed type, running probably at 460 revolutions, was employed, appeared the most satisfactory. However, it appears to the author that the Roots blower, with a vertical engine on the same bed-plate, presents many advantages. Messrs. Greenwood and Batley are now making De Laval steam-turbines coupled to fans, which possess the advantage of compactness.

The boilers installed should be capable of dealing with the refuse from the generator; and as this is rather a difficult matter, it would be interesting to know which type of furnace has proved most effectual. At Halifax, Meldrum's "Koker" stoker, having mechanically moved bars, is being tried with a view to reducing the labour of the boiler attendants.

The method of spraying or atomizing the oil, as devised by Mr. Botley, appears to be a step in the right direction. As, however, a compressing pump is required, and more than one reservoir, is it not possible to accomplish the same end by using the conical-topped carburettor (where the nozzle is protected from the blow gases), admitting the oil at a much higher temperature than usual, but at the oil-pump pressure? The almost vaporous oil, sprayed (say) at 60 lbs. pressure into the stream of water gas, ought to be in a suitable state for complete gasification.

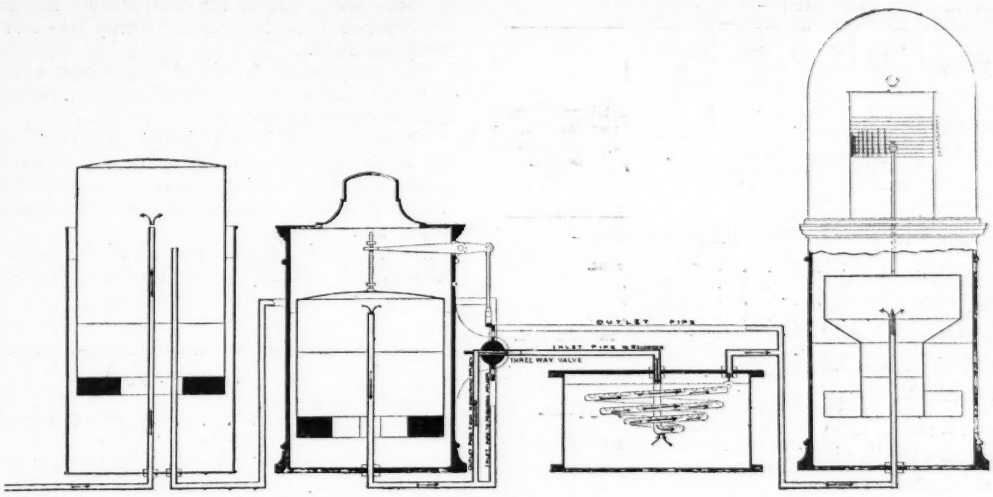
Messrs. Cutler's method of automatically raising and lowering the oil-sprayer by the turning on and off of the oil-cock, is very ingenious, and is at the same time simple, and the nozzle easily accessible.

The maintenance of a uniform temperature in the carburettor and fixing chamber is recognized by all; and it is now believed to be attainable by means of the electrical recording pyrometer. The one known by the name of Professor Callender, of Cambridge, has been employed by Mr. J. P. Leather, of Burnley. He believes the instrument to be quite accurate in its records; and by a little practice the operator learns to keep the temperature within 20° Fahr. of any desired figure. The principle of its action is based upon the fact that, as the temperature rises in the platinum points of the pyrometer, then the electrical resistance rises, and this is recorded on a paper moved by clockwork. If necessary, by another device, the instrument may be made to open or close a valve when the temperature is too high or low. The author has suggested that simplicity would be preserved, and every needful purpose answered, if the instrument rang a bell for high or low temperature, so as to attract the operator's attention.

As it appears to be almost impossible to maintain a temperature in the carburettor, which, along with the varying composition of the generator gas, shall give a constant effect upon the oil injected, there must be in practical working either a temperature slightly loo low or slightly too high for perfect gasification. If so, then it appears that the lesser of the two evils would be to have a temperature slightly too low, and (following out Mr. W. Young's ideas) to return to the carburettor the small quantity of imperfectly cracked oil. To facilitate this, would it be advantageous to circulate blast-furnace oil (on account of its cheapness) through the scrubber, instead of water?

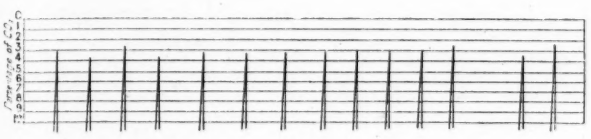
The absence of the latter would avoid the troublesome emulsion now experienced, and when the cheap oil had picked up the condensate from the Russian oil, then the mixture could be passed through the water-gas carburettor. A continuous record of the pressure in the plant is now possible; and Messrs. Thorp and Marsh have brought out a continuous test for the carbonic acid in the crude gas. To obtain tests for this impurity, it has hitherto been necessary that the chemist should devote a considerable portion of his time to the work. Messrs. Thorp and Marsh's apparatus has been designed with a view to materially lessen this routine work, and at the same time to give a considerably increased

THORP AND MARSH'S AUTOMATIC CARBONIC ACID RECORDER.



AVERAGING HOLDER. MEASURING HOLDER. ABSORBENT. CO_2 PERCENTAGE RECORDER.

[The difference in volume caused by the absorption of the CO_2 is recorded on the diagram.]



TEST TAKEN BY THE CO_2 RECORDER DURING TWENTY-FOUR HOURS.

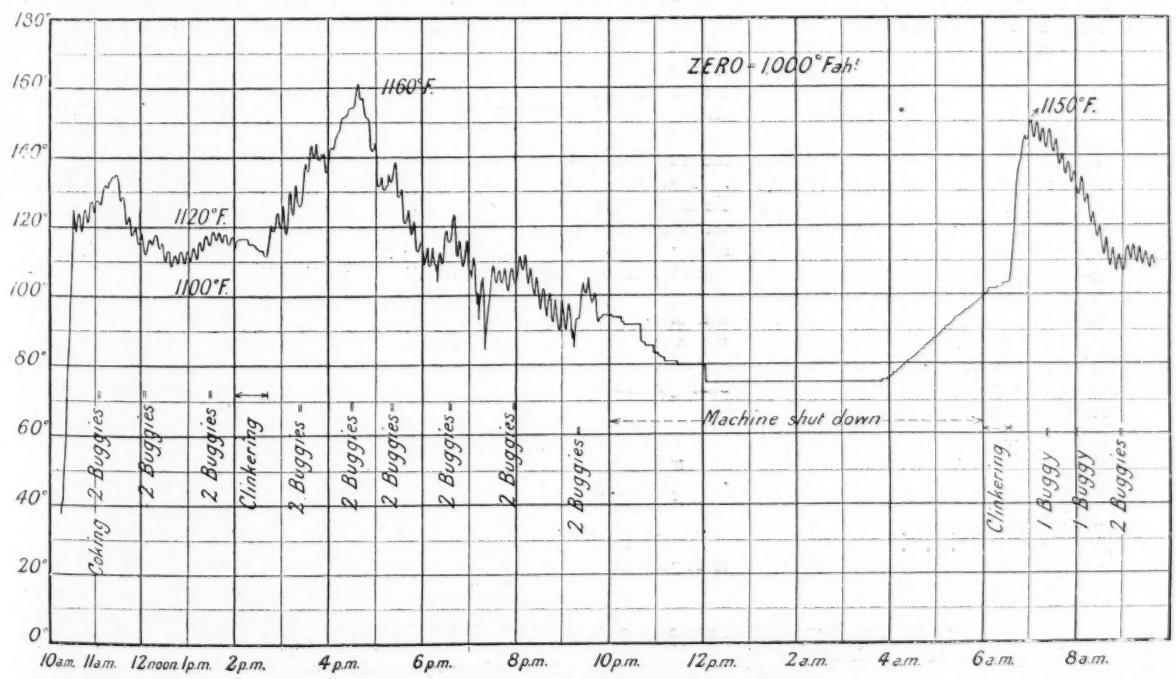
[Supplied to Mr. Holgate by Mr. T. O. Paterson.]

CO_2 estimated by Orsat apparatus at 10 a.m., 2·9 per cent.
" " " " 6 p.m., 3·1 "

number of recorder tests; all that is needful on the part of the chemist being occasional checking of the results obtained. It will at once be obvious how great are the advantages of the apparatus. It consists of three small holders and a vessel containing the absorbing solution, together with the necessary automatic mechanism, &c. The first holder is constantly receiving gas during the run, and is simply a reservoir containing an average of the gas made. The gas is then discharged into a second holder, having the same capacity as the third. When full, the automatic mechanism closes the inlet and opens up a communication with the vessel containing the absorbing solution, specially arranged for bringing the gas into most intimate contact with it. From this vessel the gas passes into the third holder, but, having now lost its carbonic acid, does not cause it to rise to its full extent—the loss being recorded on a diagram in percentage of the gas used in each operation. As each per cent. on the diagram is 2-10ths of an inch, one quarter of 1 per cent. is a very marked amount.

The stack-valve should be of such a weight, or pressure should be applied to it, so that the maximum pressure of gas on the run does not tend to lift it from its seat. The top of the fixing chamber should have a handrail to protect the man when cleaning or inspecting. The emission of flame from the stack-pipe is frequently troublesome, but is largely reduced by opening the blast-valve to the generator for about five seconds before opening the stack-valve.

The experience of many gas engineers is that the condensers (usually water-tube pattern) generally supplied with water for plant, are too small; and they have supplemented the same by others to remove, by friction or surface contact, the last traces of oil vapour. Where tanks of large capacity can be provided, the separation of the light and heavy tar from the water is greatly helped. The presence of ammoniacal liquor with the emulsion has been found to help the separation.



PYROMETER RECORD AT MANHOLE, JAN. 15-16, 1901.

The following are tests made of the water-gas tar produced from Russian Solar distillate :—

Specific Gravity at 60° F.	Water.	Light up to 170° C.	Medium up to 230° C.	Heavy up to 270° C.	Anthracene above 270° C.	
1·055	2·9 combined.	7·3	13·9	11·0	36·0	Pitch, 71·1 gramme per 100 c.c., or 67·2 per cent. by weight.
		These gave the following on rectification:				
		14·1	34·7	19·1		

The test for final products of the light oil gave—

Benzol	34·1 per cent.
Solvent naphtha	38·9 ,,
Burning naphtha	5·2 ,,
Creosote	9·1 ,,

Memo.—The tar contained only traces of bases, and no carbolic acid.

The tests of creosote oils gave—

Crude naphthalene, 10·4 per cent. by weight.
Coal tar acids, 0·5 per cent. by volume, 37° C. liquefying point.
Residue, at 300° C., 1½ per cent. by volume.

The anthracene oils yielded—

Anthracene oils, 17·7 per cent. by volume.
Coke, 1·12 grammes per 100 c.c. of oils.
Coke gave on analysis 27·05 per cent. of anthracene by weight.

The author was compelled to use an equalizer of 15 feet diameter by 15 feet high (capacity 2700 cubic feet), in conjunction with a generator of one million per day. By having at the exhauster the following appliances, the arrangement has worked very successfully: (*a*) Regulating valve, giving a constant pressure of steam to engine. (*b*) Governor controlling steam throttle valve, and operated by gas pressure at inlet to exhauster. (*c*) Governor to bye-pass valve, 6 inches diameter, at outlet of exhauster. (*d*) A 6-inch bye-pass with hand-adjusted valve.

Purification at present is through oxide and lime; but owing to the low percentage of carbonic acid, this has not yet proved to be costly. The scrubber for coal gas will in due course receive the water gas; and then by being washed with purified ammoniacal liquor, the expense will be very much reduced.

The measurement of the water gas produced each hour is a desirable thing; but in a works with small area, it is not always possible to obtain this information. In the case of two or more units of water-gas plant being worked together, some other means of discovering the working of each unit has to be devised. That being so, the conditions and tests of working should be so clearly defined as to be capable of checking without a meter being indispensable.

The testing of the generator gas and of the gas from the outlet of the wash-box, should be accompanied by particulars as to the depth of fuel, the temperature and volume of steam, and other facts, so as to make the figures as useful as possible. The illuminating power should be tested after the carbonic acid has been removed; and the kind of burner used fully explained. In some cases the quantity of gas burned in the No. 1 "London" argand is kept to the usual 5 cubic feet per hour; in other cases, the chimney is filled with flame; in others, the "F" or "Preston" standard argand burner is used; while in others, the flat-flame burner must be employed for official purposes. The use of candles or pentane, in one, two, or ten candle standards, should be stated. Again, if illuminating power is inferred from the enrichment value, this should be clearly stated. It is necessary to have tests made after purification from sulphuretted hydrogen and carbonic acid.

The following tests of flat-flame burners, will show the necessity for the consumers being furnished with a suitable appliance at a moderate cost; and the Halifax Corporation have decided to supply at cost price the best governor burner suited to the small consumer :—

Tests of Flat-Flame Burners.

	Per Hour. Cub. Ft.	Pressure. Inches.	Illuminating Power per 5 Cub. Ft. Candles.
No. 3 Bray's burner	5·00	1·3	3·40
No. 4 ,, "Special"	5·15	1·3	7·78

About 20 per cent. of water gas in the mixture, which with the "London" argand burner gave with this gas 16·65 candles.

[For further tests, see Appendix D.]

The slits in burners using a mixture of coal gas and carburetted water gas do become irregular sooner than when coal gas alone is used; and it is to be hoped the reason will be discovered and the trouble removed.

At Halifax, the deposition of naphthalene in service-pipes has been less; but in the obstructions that have occurred, the crystals have been more firmly set—not so flaky and easily removed.

The presence of a bottle of compressed oxygen is certainly desirable, and when fitted with a tube, valve, &c., is ready at a moment's notice.

I believe it will be found best to have a sufficient water-gas plant, as will normally make all required between the hours of 6 a.m. and 10 p.m. If occasion arises, then a margin is left, by working the plant throughout the twenty-four hours.

The remainder of the synopsis of my paper will not need enlargement, but may bring in matter for useful discussion.

Appendix A.

Fractional Distillation of Blast-Furnace Oil.

[Sp. gr. ·959.]

1st drop distilled at 81° C.

From ° C. to ° C.	4·0	Corresponds to	light oils.
,, ° C. to ° C.	65·0	,,	middle oils.
,, ° C. to ° C.	19·0	,,	heavy oils.
,, 270° C. to 300° C.	5·0		
,, 300° C. to 360° C.	2·0		
Residue above 360° C.	5·0		

Acids in total oils, 145 per cent. by volume.

Residue on complete distillation in a gaseous atmosphere = 0·33 per cent by weight.

Gas Made in Water-Gas Plant using the Above-Named Oil.

[Blow, 2½ min.; run, 6½ min.; at 3.20 p.m.]

Component.	1st Min.	2nd Min.	3rd Min.	4th Min.	5th Min.	6th Min.	6½ Min.	Aver.
H_2S	0·48	0·43	0·42	0·4	0·40	0·50	0·55	0·45
CO_2	0·48	0·43	0·42	1·0	2·00	3·08	3·90	1·44
N	3·89	3·88	4·56	3·4	4·11	3·90	2·54	3·85
CO	45·60	41·80	38·50	34·8	31·30	35·40	43·20	38·31
H	34·60	31·40	17·50	33·9	38·30	41·80	47·30	37·10
CH_4	9·65	17·60	14·30	22·3	17·40	13·40	1·96	14·71
C_nH_m	5·30	4·46	4·40	4·2	6·35	1·92	0·55	4·14
Total combustibles	95·15	95·26	14·70	95·2	93·35	92·52	93·01	94·26

Steam pressure, 132 lbs.; estimated temperature, 485° Fahr. Make per run, 6059 cubic feet; do. per hour, 40,000 cubic feet. Illuminating power, 14·24 candles; 3·89 gallons per 1000 cubic feet; 24 gallons per run.

Coke fed into generator at 8 a.m., 28 cwt.; 9 a.m., 14 cwt.; 9.55 a.m., 14 cwt.; 10.52 a.m., 14 cwt.; 11.58 a.m., 14 cwt.; 1·4 p.m., 14 cwt.; 2.27 p.m., 14 cwt.; 3.41 p.m., 14 cwt.

Coke per 1000 cubic feet up to 2 p.m., 44·8 lbs.; from 2 to 10 p.m., 30·4 lbs.; average, 36·53 lbs.

Appendix B.

Analyses of Gas when using Russian Solar Distillate.

[Blow, 2½ min.; run, 6½ min.; 28 gallons per run.]

Component.	1st. Min.	2nd Min.	3rd Min.	4th Min.	5th Min.	6th Min.	6½ Min.	Remarks.
H_2S	..	0·4	..	..	..	0·4	0·40	Steam, 112 lbs. pressure.
CO_2	..	0·4	..	..	..	4·8	5·60	
N	..	3·55	..	..	..	0·8	3·28	
CO	..	33·4	..	..	..	33·4	34·80	Steam temp., 320° to 370°.
H	..	27·9	..	..	..	54·9	52·60	
CH_4	..	22·35	..	..	..	3·1	2·12	Ill. power, 18½ candles.
C_nH_m	..	12·0	..	..	..	2·6	1·20	
Total combustibles.	..	95·65	..	..	..	94·0	90·72	Oil not being fully cracked.

Samples Taken at Generator at 11.30 a.m.

Component.	1st Min.	2nd Min.	3rd Min.	4th Min.	5th Min.	6th Min.	6½ Min.	Aver.
H_2S	0·40	0·40	0·40	0·40	0·40	0·60	0·60	0·45
CO_2	0·40	0·40	0·40	1·00	2·00	2·20	3·20	1·20
N	2·53	1·82	1·95	1·68	2·81	2·09	2·05	2·14
CO	45·80	44·40	43·80	42·40	41·80	40·co	39·80	42·79
H	50·10	52·20	52·70	53·70	52·20	54·30	53·50	52·61
CH_4	0·77	0·78	0·75	0·82	0·79	0·81	0·85	0·79
Total combustibles	96·67	97·38	97·25	96·92	94·79	95·11	94·15	96·19

Make per run 6771 cubic feet; do. per hour, 41,000 cubic feet; steam pressure, 115 lbs.; temperature, 485° to 495° Fahr.

Coke fed into generator at 8.25 a.m., 21 cwt.; 9.10 a.m., 14 cwt.; 10.8 a.m., 14 cwt.; 10.57 a.m., 14 cwt.; up to 2 p.m. = 46 cwt.; 2 to 10 p.m. = 28·1 cwt. Average, 35 lbs.

Sampled at 3.15 p.m.

Component.	1st Min.	2nd Min.	3rd Min.	4th Min.	5th Min.	6th Min.	6½ Min.	Aver.
H_2S	0·30	0·40	0·40	0·40	0·6	0·62	0·40	0·45
CO_2	0·40	0·60	1·00	1·00	2·2	3·94	4·20	1·73
N	3·36	2·26	1·53	3·53	3·5	3·15	1·98	2·82
CO	48·70	46·20	44·60	44·10	42·8	41·00	39·80	44·20
H	46·50	49·80	51·70	50·20	49·7	50·80	52·40	49·98
CH_4	0·74	0·74	0·77	0·77	1·2	0·49	1·22	0·82
Total combustibles.	95·94	96·74	97·07	95·07	93·7	92·29	93·42	95·00

Make per run, 7000 cubic feet; do. per hour, 43,500 cubic feet; steam pressure, 113 lbs.; temperature, 275° to 285°; illuminating power of gas, 20·20 candles.

Coke fed since at 8.28 a.m. (= 6 h. 47 min.), 105 cwt.

Coked at 2.15 a.m. up to 2 p.m. = 38 lbs.; 2 to 10 p.m. = 31·5 lbs. Average, 34·74 lbs.

Appendix C.

Sulphuretted Hydrogen and Carbonic Acid in Gases from Generator.

Time.	Min.	H_2S Per Ct.	CO_2 Per Ct.	Time.	Min.	H_2S Per Ct.	CO_2 Per Ct.	Steam.
2.15 p.m. Coke 6 ft. 5 in. thick at 2.6 p.m. 14 cwt. added at 1.57 p.m.	1	0·4	0·40	2.55 p.m. Coke 5 ft. 4 in. thick at 2.57 p.m.	1	0·4	0·8	Three-quarters of a turn.
	2	0·4	0·40		2	0·4	1·6	
	3	0·3	1·40		3	0·4	2·4	
	4	0·4	1·80		4	0·4	3·2	
	5	0·4	3·00		5	0·4	3·8	
	6	0·4	3·40		6	0·4	4·6	
	6½	0·4	4·60		6½	0·4	6·2	
Average . .		0·4	1·95	Average . .		0·4	3·0	..

A difference of 13 inches in depth of fuel shows a difference of 1·05 per cent. in carbonic acid.

Time.	Min.	H_2S Per Ct.	CO_2 Per Ct.	Time.	Min.	H_2S Per Ct.	CO_2 Per Ct.	Steam.
3 20 p.m. Coke 6 ft. 3 in. thick at 3 o'clock. 14 cwt. added at 3 o'clock.	1	0·60	0·40	3.55 p.m. Coke 5 ft. 11 in. thick at 3.57 p.m.	1	0·4	0·60	Seven-eighths of a turn.
	2	0·60	0·40		2	0·4	1·20	
	3	0·40	1·40		3	0·4	1·60	
	4	0·40	2·60		4	0·4	2·60	
	5	0·40	3·00		5	0·5	4·00	
	6	0·40	3·40		6	0·4	4·60	
	6½	0·40	4·60		6½	0.4	5·40	
Average . .		0·46	2·08	Average . .		0·4	2·66	..

A difference of 4 inches in thickness of fuel shows a difference of 0·58 per cent. in carbonic acid.

Appendix D.

Tests of Governor Burners with a Mixture of Coal Gas and Carburetted Water Gas.

Burner.	Consumption.	Candles.	Consumption per Cubic Foot.	Percentage of A.	—
Jan. 10, 1901.				Difference.	
"London" argand	5·00	16·20	3·240	100·00 ..	A
Cone-top flat-flame	5·63	14·35	2·549	76·70 8·92	B
Table-top ,,	5·92	13·34	2·253	67·78	C

With Coal Gas Only.

Burner.	Consumption.	Candles.	Consumption per Cubic Foot.	Percentage of A.	—
				Difference.	
"London" argand	5·00	14·50	2·900	.. ..	A^1
Cone-top flat-flame	5·75	10·92	1·809	62·38 of A^1	B^1
Table-top ,,	6·31	9·74	1·544	53·24 9·14	C^1

Mixture of Gas as Below (x).

[Probably 20 per cent. of carburetted water gas.]

Burner.	Consumption.	Candles.	Consumption per Cubic Foot.	Percentage of A.	—
Feb. 27, 1901.					
"London" argand	5·00	18·10	3·62	..	A^2
Cone-top flat-flame (specially prepared)	4·84	16·98	3·51	96·9	B^2
	4·80	16·99	3·54	97·8	B^3

Mixture of Gas as Below (y).

[Percentage of carburetted water gas uncertain.]

Burner.	Consumption.	Candles.	Consumption per Cubic Foot.	Percentage of A.	—
March 1, 1901.					
"London" argand	5·0	18·070	3·614	..	A^3
Cone-top flat-flame (specially prepared)	5·4	18·954	3·510	97·1	B^4

Analyses of Mixed Gases Used in Testing Flat-Flame Burner.

Component.	Sample *x*.	Sample *y*.	Component.	Sample *x*.	Sample *y*.
H_2S	nil	nil	CO	11·8	8·8
CO_2	nil	nil	H	53·7	60·7
C_nH_m	4·2	4·2	CH_4	29·3	25·3
O	nil	trace	N	1·0	1·0

Discussion.

The President said he was sure all would agree that Mr. Holgate had presented them with one of his characteristic papers, which dealt with the subject from many points of view; and it was well worthy of discussion—particularly the portions which gave an insight into the effects of fuel-beds, steam and air pressure, &c.

Mr. S. Y. Shoubridge (Lower Sydenham) expressed his thanks to the author for bringing the subject before the meeting in such an interesting manner. He could answer the question Mr. Holgate asked in it with regard to water-cooled valves. He had had them in use for about two years, and he was sorry to say they had proved to be altogether unsatisfactory. After a very short time, the sediment from the water had choked up the passages and put the water-circulating system out of use. He thought they might be improved; but as at present designed, they were certainly not to be commended. Another important point was with regard to washing the gas with oils instead of with water, as at present. He thought this would have a very good effect. The paper was so long, and so full of detail, that it was impossible, on the spur of the moment, to say all that one might say about it. It required a deal of study, and he was sure it would be of very great use to those who were engaged in water-gas manufacture.

Mr. C. F. Botley (Hastings) said he agreed that the paper naturally appealed to those who, like himself, took an interest in water-gas manufacture. He gathered that Mr. Holgate was in the habit of working at very low temperatures. He himself had worked out one or two of that gentleman's results; and using blast-furnace oil (which was very bad oil), the results came out at 3·6 candles per gallon. But working with Russian "Solar" distillate, results were obtained which showed 5 candles per gallon; and he could not help thinking as he followed Mr. Holgate's remarks, that he must have sacrificed some heat between his carburettor and superheater. With regard to the fuel in the generator, he had found that there was a zone of influence, or a height at which one could keep the coke without affecting the carbonic acid to any extent. If they got into the zone of influence, a very little difference in the thickness of the bed of fuel would make a difference in the result. If they could keep the carbonic acid down to 2 per cent. they would rejoice. They generally ran at 3 per cent.; and he regretted to say that their fuel compared very unfavourably with what Mr. Holgate had been having. That gentleman, he thought, took the average as being 35 lbs. for generator fuel. Mr. H. E. Jones, in his paper at the Institution of Civil Engineers (*ante*, p. 1055), gave the coke used per 1000 cubic feet at nearly 48 lbs.; and taking the boiler fuel at 5 or 6 lbs., this would be about 42 lbs. in the generator. This was, he believed, in accordance with the general practice. He also saw, on referring to Mr. Jones's paper, that his candle-feet value was 1208, or 6·03 candles per gallon, which was more than Mr. Holgate gave. For those who used it, the candle-feet value, or candles per gallon, was very important. With regard to water-cooled valves, they never had them at Hastings. Generally speaking, they had very little trouble indeed with their ordinary up-and-down valves. With reference to Mr. Holgate's superheaters, he presumed they were on Lancashire boilers; and he understood that it was generally thought they gave a great deal of trouble in gas-works. As to the boiler used in connection with water gas, the speaker said they had lately installed a water-tube boiler; and they used the fuel left

rom the generator to very great advantage indeed. In fact, the firemen preferred it to the ordinary coke. Then with regard to the runs, these seemed to be of only 5 minutes' duration; but in the South of England, they generally went up to 7 minutes. Unfortunately, they were not able to work with such short blows as seemed possible in the present instance. As to hot coke for the generator, if the relative positions admitted of it, he should say it was an advantage; but if it was a long way off, the wear and tear must go against any saving in the heat of the fuel put into the generator. Continuous feeding was a very promising point; and he would endeavour to make a trial of it. As to the form of coke-feed, to which the author referred, and by which one man could do the work, he had seen two men doing it with the sliding door. He had a cone at the bottom at his place, which had the advantage of distributing the coke. He certainly liked the sliding-door arrangement. Turning to the subject of blowers, some had had various mishaps with the fans. What was wanted was the alternating system. If they had the engine and the fan, it seemed to him there would be a larger capital outlay than by the simpler arrangement of direct driving. On the subject of oil, for a long time they used a quality which gave satisfaction; but during last winter unfortunately they got hold of some which they even now did not understand. He thought it must be blast-furnace oil. The result of using the atomizer with this oil had been very unsatisfactory—in fact, he was almost prone to admit that it was better to use the old form of sprayer. There were difficulties as to the heating of the oil to the necessary extent. The oil now would be heated when it got into the cylinders with which the atomizer was connected; and this would be a source of risk. The heating of the carburettor was of vital importance; and he rejoiced that they had such a good report before them. The same remark applied with regard to the carbonic acid. The emission of flame in the stack-valve rather struck him; and he thought the emission must be due to the imperfect gasification of the oil. It was a carbon flame, and not the usual flame which came from the blowing-up gases. Coming to the question of testing, he was glad to see that the author had taken the matter up. He had been endeavouring to find out certain differences in various experiments that had been made; and with regard to the small test-box, he believed the gas was taken into that for the pyrometrical tests, whereas at Hastings it was taken a considerable distance away. In some results obtained recently, it was found that one plant tested with candles gave 19·60 candles, or 6·63 candles per gallon. He was very glad to see the particulars which had been given with regard to burners. It had been a serious matter with him for a long time, in consumers' interests, to know that the burners generally adopted were not the most satisfactory. He had got over the difficulty in some cases by using the Eureka caps; but this was a very crude way. He had, he might mention, also found that Bray's slit-union gave rather better results as regarded illumination.

Mr. J. W. Helps (Croydon) said the paper added considerably to their knowledge of water gas; and it showed how advantageous and how important it was to combine technical knowledge with practical skill. It was only by the exercise of technical knowledge that they were ever able to find out what was going on during any manufacturing process. On the other hand, there was perhaps one mistake which a manager was likely to fall into, and that was that, in tracing up one or two particular points, there was liability to lose sight of a few others. Mr. Holgate would excuse him when he said that it appeared to him that that gentleman had been testing with one or two principal points in view—keeping down, first of all, the quantity of coke used, and secondly the carbonic acid; and it was possible to forget that when one was aiming at perfection, or as near it as possible, in one direction, something might be lost on the other hand. Mr. Holgate's results seemed to him to prove that something of the sort had happened at Halifax. Mr. Botley and he had worked out the oil results. He might mention them without going into the question of how their results were obtained. In the course of twelve months they got 7·46 candles per gallon of oil, and used 36·7 cwt. of coal per 1000 cubic feet of gas in the generator, and just under 4 cwt. in the boilers—making rather more than 40 cwt. altogether. They found that though at times they could work at less than 3 per cent. of carbonic acid, when they attempted to do this their general results were so much reduced that really the reduction of carbonic acid ended in a loss. If they were enabled to reduce the carbonic acid, they would be only too glad to do it. With regard to the superheating of the steam, he had often thought this was a step in the right direction; and he felt quite certain that if Mr. Holgate could give them any further information on the subject, and tell them whether there was any difficulty in the matter, the members would be very much obliged to him. As to the depth of the coke in the generator, the author had given them some particularly interesting figures, and had pointed out distinctly that if anyone did go too far with the depth of fuel the rise in carbonic acid would be very excessive. He should like to ask whether the results were those of a series of tests, or were taken hap-hazard. Turning to the question of boiler furnaces, it seemed to him that the method of producing steam in water-gas plant was a very important matter. The furnaces should be easily accessible to everybody, because of the tar which would be burnt under the boilers. But the difficulty experienced had been in getting the tar into such a condition as to permit of it being burnt in the burners. They had hitherto utterly failed to make a tar that would burn easily; and if Mr. Holgate would inform him how he could produce his tar in such a way as to get it with only a small percentage of water in it, he should be very much obliged to him. As to the suggestion of coal gas being used in connection with water gas, he considered the coal tar and water-gas tar would become mixed. In that event, did not the author think that the tar distillers would raise some objection? Mr. Holgate had mentioned naphthalene; and he (Mr. Helps) agreed with him there. It became very much harder set when water gas was used than when it was not. The particulars about burners were very useful; and he intended asking Mr. Holgate to let him have a sample of one of the burners which gave such good results as compared with the argand. His own experiments showed there was considerable loss in the burners which were available to most consumers.

Mr. S. Meunier (Stockport) said the manufacturers of water gas had undoubtedly found many of the difficulties that Mr. Holgate had mentioned. He (Mr. Meunier) had not been in a position to carry out the analyses which that gentleman had made, and find out the cures which he had been endeavouring to effect. Considering the experience of others, he noticed that the author's results did not appear to be quite so high as he would have anticipated. In his own case, taking the average for four years running, his candles had come out per gallon per 1000 feet at something over 7. The consumption of coke worked out at a little under 35 lbs., while that used under the boilers was considerably higher than the last speaker had mentioned. The figures worked out at very nearly 10 lbs., which was no doubt due to the fact that they utilized the coke from the generator clinker. It was all weighed to the doors. One of the difficulties he had particularly noticed, and as to which he was endeavouring to arrange a test, had been mainly the question of the spraying of the oil. When Mr. Botley read his paper last year, he (Mr. Meunier) thought the vaporizer would have given much better results than he had been previously able to notice; and he was one of those who were rather disappointed that the results were not better. Various methods of altering the size of the injector, and also the pressure, had been tried, and varying results had been obtained; but unfortunately they had never been able to get a definite explanation of the reason for them. It must be largely due to the human element, which was of such importance. The keeping up of the temperature of the carburettor and superheater was very important. As to the pyrometer, when he had had a little more experience he should go more fully into the subject, which was a very interesting one. He had discussed it with many people; but, so far, he had never had a pyrometer brought to his notice which would give correct results with continuous working. When a perfect instrument was devised, one of the most serious troubles with which they had to deal would be eliminated. As to the carbonic acid question, he had found the same results as others had. When they had endeavoured to reduce the percentage, there had invariably been worse results. But, after all, this was one of the minor questions, to which undue importance should not be attached. The main factor in the cost of production of water gas was the working of the oil and getting the highest results obtainable from the gasification. On these lines he himself had been endeavouring to work. He had tried to keep the carbonic acid as low as possible, and when they found that they had more than 3 per cent. of it in their gas,

they had been able to get much higher results from the oil. With them the cost of manufacture had been very regular. They had taken into consideration everything, including the varying price of coke, which, by the way, he thought was unfair. Still, they had been able to put into the holder gas of 23 candles at about 13d. per 1000 cubic feet, which was not a very bad record for such a quality. Of course, the price of oil raised the total somewhat; but they looked to getting this back in the future. He hoped shortly to be in a position to find a cure for some of the difficulties which had hitherto been met with. When the instrument with which the tests were made was at a great distance, instead of being on the spot, there was a certain disadvantage This he, personally, hoped soon to obviate. There were other points on the subject of tar and naphthalene, by which the illuminating power of the gas was affected. He would think out these and other matters, and, if possible, make some experiments.

Mr. J. D. Ashworth (Portsmouth) said he certainly found that the oil results were not so good as he expected. At Portsmouth, he was getting 7·2 candles per gallon. With regard to coke consumption, this was approximately 36 lbs. per 1000 cubic feet. The carbonic acid was very variable—ranging from 3·5 to 4·5 per cent. As to tar, he had had considerable difficulty in burning water-gas tar, there being such a large percentage of water in it; and what he had done was to put down a tar-settling tank. By this means he had been enabled to burn the tar in the boilers, and also use the lighter oils which flowed from the top of the tar-separating tank. Previous to taking the tar from the separator, he used a small suction-pipe, which emerged just into the light oil—say about ¼ inch—and thus he could take the lighter oil away.

Mr. D. H. Helps (Redhill) noticed that Mr. Holgate gave useful information in connection with high-pressure as compared with low-pressure apparatus. He personally did not know anything about the Dellwik system, and had hoped to hear something thereon. The author had given the cost of a mixture of "4 coal gas, 1 water gas," as 10·86d., and his own estimate was 11·7d. per 1000 cubic feet. If this were all coal gas, it would only give 1d. more; and against this Mr. Holgate stated that the carbonic oxide was much higher and the calorific power lower. Again, there was another disadvantage; the gas being mixed in the hydraulic main would increase the difficulty of purification, owing to the larger percentage of carbonic acid in water gas as compared with coal gas. Therefore he could hardly think that the Dellwik process would be any better than the low-pressure process.

The President said Mr. Dellwik was present, and perhaps he would kindly make a few observations on the paper.

Mr. Carl Dellwik expressed his pleasure in complying with the President's request. He did not know whether Mr. Holgate had obtained his analysis from any of his (the speaker's) clients. Anyhow, looking at the analysis, it certainly did not seem to work in the manner it should, because the proportion of carbonic acid during the blows should certainly be much higher than 10 or 11 per cent. He might say that Professor Lewes had found an average of about 17 or 18 per cent. Then there was a very general impression that the decomposition of the steam would necessarily not be so complete in a low bed of fuel as in a deep one. This was somewhat erroneous. If they had a deep bed of fuel, the steam was not decomposed to the entire depth, but only in the part heated to the proper temperature. The method of blowing used affected it; and the last 4 feet of fuel in a deep bed would not be so hot as a bed of 4 feet of fuel blasted by a very strong blast. Therefore the decomposition would not be so favourable as one would expect. With regard to the analyses, he found that the average percentage of the components of the gas, and more particularly the carbonic acid, was the average of the different analyses. He thought they were taken every minute, and the average was the average of these analyses. This would not be quite right, because in the later minutes of the run the production of gas was very much smaller. So that instead of this kind of average, there should be an analysis of the finished gas on the whole. Mr. Holgate had made some tests with his generator at Halifax, in which the percentage of carbonic acid was very much higher when a lower bed of fuel was employed. He (Mr. Dellwik) thought, however, considering the importance of the depth of the fuel, the results would have been quite different if a stronger blower had been used. Referring to Dr. Strache's paper on the production of water gas, that gentleman had arrived at very different results from his own. He had found it possible to blow a bed of fuel to carbonic acid at a high temperature. So it could be seen that they did not work at so low a temperature as was suggested. Of course, he did not wish to discredit that gentleman's experiments. Something had been said about the relative merits of carburetting with oil and with benzol. As to this, he would merely remark that it was only a question of price, because at the present time benzol was much cheaper than oil, and the same power was obtained at considerably lower cost.

Mr. J. T. Westcott (London) said the efficiency of carbonic acid varied with the difference in the apparatus. For instance, if they took two sets of apparatus, made from the same drawings, and placed them in the same building, and manufactured by the same person, it would be found that the two sets would vary, more or less. Every set seemed really to have its own particular equation; varying just the same as individuals varied. Not only this, but the efficiency of the plants varied greatly according to their size. For instance, if they started making gas with a small plant, they would get certain results; and a plant that would make 100,000 cubic feet per day, would not give such good results as one making 750,000 cubic feet. The efficiency gradually increased according to the size of the apparatus, until it got up to from 750,000 to 1,000,000 cubic feet per day. But when they went above this point, his experience taught him that the efficiency gradually ran down. He would leave Mr. Holgate to give some of the reasons (which he could do) why his candle powers were not higher than they were. He (Mr. Westcott) would merely say, on this head, that Mr. Holgate's plant had only been started a very short time, and had not yet been entirely what he might call diagnozed. A point to be noticed was that Mr. Holgate made 1,500,000 cubic feet per day; and he contended that, with this high output, the efficiency was not so great as that of a plant which had a smaller capacity. With reference to valves, when he (Mr. Westcott) designed the larger plants, they put in the same sort of valve which they used for smaller sets; and he felt sure that they would now have no trouble whatever with these water-cooled valves. Some years ago, he had a beautiful theory. He thought he would tabulate a series of rules by which any man—no matter how ignorant he might be—could operate a carburetted water-gas plant. First of all, four of the ablest scientists were to make a series of very elaborate experiments on the various plants. The best pyrometers and thermopiles were used. A good deal of time and money were expended; but it was ultimately found that he was just as far from tabulating as he was before the experiments. So there was still a good deal to learn as to the manufacture of carburetted water gas. His opinion was that the subject was simply in its infancy; and comparisons were so difficult that to-day they knew practically nothing as to where they were.

The President said there was one point he noticed particularly, and that was there seemed to be a desire to ensure a uniform thickness in the fuel-bed. He did not think there were any mechanical difficulties in this respect. It could be accomplished by having a hopper over the producer-head, with a revolving drum beneath, and a couple of pockets. Then the feed would be constant, and there would be no bye-pass between the hopper and the producer itself. He personally intended trying such an arrangement, so as to ensure a constant feed to the producer and a uniform depth of fuel. With regard to the cost of working at Edinburgh, he had a statement (handed in, see p. 1214) of everything since they started there; and it gave all details, except as to fuel. The practice differed in the latter respect, because they used Scotch oil; and they used 6·5 candles per gallon.

Mr. Holgate (in replying on the discussion) said, in answer to Mr. Botley's inquiry as to the samples taken at the generator, given in Appendix B, the first set of analyses were for the gas at the carburettor; while the succeeding analyses were of samples taken at the generator. Mr. Botley also asked as to the tests in reference to the depths of fuel. The two tests in question were made specially to find the effect of low coke beds. Of course, their usual working-level was much higher than that stated; but the two tests referred to were made expressly on one particular day, in order to find out what all the conditions were, and the effect of a reduced depth of fuel. The figures given referred only to those particular tests. In the appendices, there were figures as to coke and oil results; but they only referred to the particular tests to which they were attached, and did not

represent an average over any period. He did not see how any advantage could be gained by mixing up the two questions—viz., as to the percentage of carbonic acid in the gas and the efficiency of the oil results—because they had no information to show that increasing the percentage of carbonic acid increased the gasification of the oil. He supposed the only way they could expect better oil results, would be that, if they admitted a greater quantity of steam into the generator, they would make a larger quantity of water gas with more carbonic acid. There were many doubtful points with reference to manufacture; and if these could be cleared up one by one, the way would be paved towards the elucidation of other matters. As to the question of superheaters, these were fixed at the back-ends of Lancashire boilers, and consisted of a number of bent tubes (a very simple arrangement). No trouble had been experienced with them; and there was no reason, so far as he could see, why they should not be generally employed. As to the oil figures referred to by Mr. Helps, none were given, the question not being raised; and, besides, he did not think it was germane to the question. As to the mixture of coal tar with water-gas tar, he might say that it was their intention at Halifax to distil their own tar; so that they did not anticipate any difficulty on this score.

Cost of Manufacturing Carburetted Water Gas—May 16, 1898, to May 15, 1899.

Description.	Rate.	Total Cost.	Cost per 1000 Cub. Ft.	Amount per 1000 Cubic Feet.
			Pence.	
Carburetted Water Gas made, 165,556,000 c.ft.				
Manufacture—				
Wages	..	£799 12 4	1·13	
Oil used, 2639 tons, at per ton	£2 16 9·8	7,496 0 0	10·87	4·1 gallons.
Coke used, 2241 tons, at per ton	0 6 0	672 6 0	0·91	30·0 lbs.
Water used, 3,899,000 gallons, at per gall.	0 0 4	64 19 8	0·09	24·0 gallons.
				Coal Gas.
Purification—				
Lime used, 1348 tons, at 12s. 9d., £859 7 0	..	..	1·24	18·2 lbs. 10·0 lbs.
Wages . . 393 18 2	..	..	0·57	
Repairs, &c.—		1,253 5 2	1·81	
Materials & stores £165 0 0	..	..	0·24	
Wages . 143 10 11	..	..	0·21	
		308 10 11	0·45	
Salaries — Proportion per 1000 cubic feet	0·32d.	220 14 10	0·32	
		£10,795 8 11	15·58	
Credit—By amount of tar sold, 617 t. 6 c., at 17s. 6d., equivalent per ton of oil used	4s. 1·1d.	540 2 8	0·78	
Capital. — Carburetted Water Gas, £24,264 at 5 per cent.	..	1,213 4 0	1·76	
		£11,468 10 3	16·56	

Candle power—
Average tests . . . . . 26·28
Per gallon per 1000 cubic feet . . . 6·41
Sperm value—5757 lbs. per ton of oil.

Cost of Manufacturing Carburetted Water Gas—May 16, 1899, to May 15, 1900.

Description.	Rate.	Total Cost.	Cost per 1000 Cub. Ft.	Amount per 1000 Cubic Feet.
			Pence.	
Gas made, 211,652,000 cubic feet.				
Manufacture—				
Wages	..	£970 7 7	1·10	
Oil used, 3173 tons 2 qrs., at per ton	£3 0 7	9,610 19 7	10·89	4 gallons.
Coke used, 3286 tons, at per ton	0 8 0	1,314 0 0	1·49	34 lbs.
Water used, 4,579,000 gallons, at per gall.	0 0 4	76 6 4	0·09	21 gallons.
				Coal Gas.
Purification—				
Lime used, 1560 tons, at 12s. 9d., £994 10 0	..	..	1·12	16·1 lbs. 9·1 lbs.
Wages . 413 14 9	..	..	0·47	
Repairs, &c.		1,408 4 9	1·59	
Materials & stores. £194 1 1	..	..	0·22	
Wages . 152 0 4	..	..	0·18	
		346 1 5	0·40	
Salaries — Proportion per 1000 cubic feet	0·32d.	282 4 1	0·32	
Credit.—By amount of tar sold, 753 t. 14 c. at 17s. 6d., equivalent per ton of oil used	4s. 1·7d.	£14,008 3 9	15·88	
		658 17 6	0·75	
Capital. — Carburetted Water Gas, £24,264, at 5 per cent.	..	£13,349 6 3	15·13	
		1,213 4 0	1·37	
		£14,562 10 3	16·50	

Candle power—
Average tests . . . . . 26·07
Per gallon per 1000 cubic feet . . . . 6·52
Sperm value—5855 lbs. per ton of oil.

Cost of Manufacturing Carburetted Water Gas—May 16, 1900, to March 31, 1901.

Description.	Rate.	Total Cost.	Cost per 1000 Cub. Ft.	Amount per 1000 Cubic Feet.
			Pence.	
Gas made, 182,643,000 cubic feet.				
Manufacture—				
Wages	..	£916 2 2	1·20	
Oil used, 2675 tons 6 cwt., at per ton	£5 0 11	13,499 10 5	17·74	3·8 gallons.
Coke used, 3000 tons, at per ton	0 11 0	1,650 0 0	2·17	36 lbs.
Water used, 4,466,000 gallons, at per gall.	0 0 4	74 8 8	0·09	25 gallons.
				Coal Gas.
Purification—				
Lime, 1080 tons, at 14s. 3d. £769 10 0	..	..	1·01	13·2 lbs. 8·1 lbs.
Wages . . 193 10 6	..	..	0·26	
Repairs, &c.—		963 0 6	1·27	
Materials & stores £167 8 6	..	..	0·22	
Wages. . 113 11 7	..	..	0·15	
		281 0 1	0·37	
Salaries — Proportion per 1000 cubic feet .	0·32d.	243 10 5	0·32	
Credit.—By amount of tar sold, 559 tons 10 cwt., at 17s. 6d., equivalent per ton of oil used	3s. 8d.	£17,627 12 3	23·16	
		489 11 3	0·64	
Capital. — Carburetted Water Gas, £24,264, at 5 per cent. for 10½ months.	..	£17,138 1 0	22·52	
		1,061 11 0	1·39	
		£18,199 12 0	23·91	

Candle power—
Average tests . . . . . 25·64
Per gallon per 1000 cubic feet . . . . 6·75
Sperm value—6061 lbs. per ton of oil.

PURIFICATION, AND METHODS OF WORKING PURIFIERS.

By B. W. Smith, of Walsall.

The title of this paper may be somewhat misleading, as it is not intended to deal with the full process of purification from the inlet of the condensers to the inlet of the station-meters, as the subject covers too large an area, and would occupy more time than is placed at our disposal. Still there are several points well worthy of noting, to which it would be well to draw attention in passing to the purifiers, as they really form very salient features in helping to secure both satisfactory and efficient purification. If the author may be permitted to say so, the ideas are not so much addressed to engineers and managers of large works as to others in charge of smaller works, who have had neither the experience nor the opportunity of ascertaining the best means of purification.

From the hydraulic main to the condenser the gas should be relieved of its heavy tar and other liquids, as it is more easily cooled when the hot tar is removed. It is a debatable point whether the supposed benefit of allowing the tar to travel with the gas to the condensers is of any value for increasing the illuminating power.

While the gases should gradually cool down in the condensers, the temperature at the outlet should average about

60° Fahr.; for if the proper temperature is not maintained, extra work is necessarily thrown upon the other parts of the purifying plant.

The scrubbing and washing plant is not always the same in gas-works. In many the scrubbing and washing is performed by passing the gas through tower washers, where the tar passing the condensers is removed in the first tower by scrubbing and washing with strong liquor, and the ammonia in the second by washing with clean water. Then, again, in other works where the Livesey washer is used, this is more perfectly performed by bringing the gases in a state of minute subdivision into contact with a constant stream of strong liquor. In either case, the effect is more or less of the same nature; but there is little doubt the latter lends itself more readily to the work required in the separation of the tarry particles, while the action of the strong liquor takes up its share of sulphuretted hydrogen and carbonic acid. And here it would be well to say that the greater the efficiency of the strong liquor, the less the work is thrown upon the purifiers; and, further, the more perfect the elimination of the tar, the better is the duty-power of the clean-water washer for the extraction of the ammonia and also the lifetime of the material in the purifiers.

The purifiers are constructed in many sizes and forms, to meet the requirements and experiences of the different engineers; but the old form of water-luted boxes still seems to be the favourite, although the closed ones on Green's system appear to be somewhat more generally known and adopted in a number of works. And it might be mentioned that at Walsall we are about to put down four pairs of boxes 48 feet by 18 feet by 6 feet deep. This it was decided to do in view of the existing accommodation, which would not permit or lend itself to the same area of purification if the ordinary type were used.

On the author's arrival at Walsall two different methods of purification were in vogue—viz., in No. 1 section oxide was used first and lime afterwards, similar to the method in use at Smethwick; and in No. 2 section lime came first and oxide afterwards—this being the one preferred by the writer's predecessor. This led the author to make inquiries so that he might obtain the views of others upon the various systems of working the purifiers; and he thought while doing so he would ask those using oxide what amount of material they used per annum and the spent produced, so that he could calculate from the figures, and form a fair basis of the duty-power and what gas was purified per ton of material. In replying to his circular, the President wrote and suggested that the author should summarize the results of his inquiries, and give a paper upon the subject. The inquiries were then extended to every known gas-works in the United Kingdom. But the writer regrets to say that, had he only known the difficulty he would experience in obtaining these particulars, and the shyness with which they have been supplied by his professional friends, he would certainly have hesitated before attempting his present task.

Although tried at several works with varying success, the operation of the complete removal of the sulphuretted hydrogen, carbonic acid, and most of the other sulphur compounds, by washing the gas with strong concentrated ammonia liquor in closed vessels, does not appear to have found favour in the profession; so one is still limited, so far as experience has gone, to only two or three materials for purification. It is then a question as to which is the best method of utilizing this limited choice; and the author has prepared a tabulated statement, giving a summary of the answers obtained from the various gas-works. This he would like to say might have been much more complete and satisfactory had the whole of his inquiries been replied to, although he would be wanting in courtesy were he not to express his thanks and indebtedness to all those who have so kindly answered.

In 998 gas-works in England and Wales, 546 use lime only, 81 use oxide only, and 371 use oxide and lime in conjunction.

Of the 371 using the two materials, 199 use oxide first, then lime, 85 use lime first, then oxide, and 87 use them alternately in layers or in both positions.

In 184 works in Scotland, 169 use lime only, none use oxide only, 5 use oxide first, then lime, and 10 use them alternately.

In 82 works in Ireland, 65 use lime only, 5 use oxide only, 5 use lime first, then oxide, 4 use oxide, then lime, and 3 use them alternately.

The total being 1264 works, of which 780 use lime only, 86 oxide only, 90 lime, then oxide, 208 oxide, then lime, and 100 use them alternately, or sandwiched in the same box. The percentages being—

Lime only	61·7
Oxide only	6·8
Lime first, then oxide	7·1
Oxide first, then lime	16·5
Alternately, or sandwiched in same box	7·9
	100·00

It would be well, before discussing the merits of the various methods, to mention that in some cases Weldon Mud is used, but chiefly in some of the London works; and an analysis of this, as well as of samples taken of the different oxides offered, is given, to show of what the purifying materials are actually composed.

Weldon Mud is a bye-product obtained in the manufacture of bleaching powder; being hydrated peroxide of manganese. It is not generally known or used as a purifying agent, owing to its first cost, and also to its property of absorbing carbonic acid, which prevents its action on sulphuretted hydrogen. In using Weldon Mud, it is therefore necessary to previously remove all the carbonic acid. This means that it can only be used in the final boxes or position.

Weldon Mud.

Hydrated oxide of iron	0·86
Hydrated manganese peroxide	46·65
Silica	0·89
Carbonate of lime	5·20
Moisture	46·40
	100·00

The more generally adopted method which appears in the tabulated statement, shows that lime only is used; but as the great majority of the works are not under the sulphur clauses, it tends to point to the lime being worked in the whole of the purifiers and allowed to take its chance—sometimes acting as a carbonator, and at other times as a sulphide box, while at others as a catch-box. Under this system, clean lime will not arrest the sulphur compounds, as it is only in certain stages that the boxes are performing their proper duty, besides which, as a rule, it is no doubt the most expensive method of purifying.

Under the sulphur clauses, the lime purification is somewhat of an elaborate, delicate, and costly process. The whole of the carbonic acid must be taken out by the first set of purifiers; the second used as sulphide boxes; and a third set as catch-boxes. But in working this way, it is imperative that when once the lime in the second set is sulphided, no carbonic acid must pass forward, or else the action of removing the sulphur compounds, other than sulphuretted hydrogen, is destroyed. Where lime and then oxide is used, the lime is only performing an uncertain duty, taking up sulphuretted hydrogen until this is pushed forward to the oxide boxes by the carbonic acid. So that if oxide is used first and lime afterwards, a much more convenient system is arrived at. The sulphuretted hydrogen can be caught in the oxide, and the carbonic acid in the lime; having as a resultant the sulphur in a saleable form, with probably cyanides as well, the lime being in a state which is neither a nuisance nor bad to remove; and under these conditions it could be recovered as practically pure lime by Hislop's process of re-burning. Whether this would be economical, would depend upon the price of new lime in the particular district.

Lime and oxide are in some cases used in the same purifier. This is a very prevalent practice in small works, or where the purifying area is limited. It is usual to put first a layer of oxide and then lime, or *vice versâ*, in which case, unless matting is provided, the oxide soon becomes charged and spoilt by the lime falling through the sieves, besides which the matting, unless great care is taken in keeping it clean by shaking at each change of box, produces additional back-pressure. In addition to the foregoing objections to the alternate layer system in the same box, it should be noted that by far the larger proportion of valuable cyanogen compounds are lost in the lime. In one works, the spent oxide used to be of very little value until they were persuaded to do away with the lime layer in the oxide boxes, and to use lime only as a final catch. The percentage of prussian blue in the oxide then rose from 1·3 per cent. to 8·1 per cent.; so that their spent oxide, from being difficult to get rid of, is now a valuable source of revenue, and the author feels sure that many gas engineers now using the alternate layer system would materially reduce the cost of purification, even if they did not actually make it into a source of profit.

Spent Oxide Spoilt by being Used in same Box with Lime.

Sulphur	25·46
Prussian blue	1·90
Hydrated ferric oxide	5·30
Sulphocyanides	0·48
Lime compounds	21·87
Organic matter	11·10
Moisture	33·89
	100·00

The writer has prepared a list of analyses taken of various samples of oxide he has had submitted to him. The names, of course, are obviously omitted. As the natural oxides are sold with the stipulation that any percentage of moisture over 50 per cent. shall be allowed for, he has had all the analyses calculated on a basis of 50 per cent. of moisture. They are, therefore, more readily compared one with the other, and fairly represent what is actually purchased; and in the author's opinion this method conveys a clearer idea of what is actually paid for. The method of determining the amount of oxide of iron in the dried sample is not so clear, and gives the impression that the oxide is richer than is actually the case. As it is unusual to stipulate any percentage of water with the artificial oxides, the analyses of the actual samples are given just as they were received.

Bog Ores.

	No. 1.		No. 2.
Hydrated ferric oxide	31·81	..	31·37
Hydrated ferrous oxide	—	..	1·69
Phosphate of iron	4·49	..	0·93
Silica	4·96	..	3·01
Organic matter	8·74	..	13·00
Moisture	50·00	..	50·00
	100·00	..	100·00

	No. 3.		No. 4.
Hydrated ferric oxide	25·38	..	34·98
Hydrated ferrous oxide	2·96	..	1·40
Silica	9·51	..	2·39
Organic matter	12·15	..	11·23
Moisture	50·00	..	50·00
	100·00	..	100·00

	No. 5.
Hydrated ferric oxide	22·71
Aluminic hydrate	10·67
Silica	4·65
Carbonate of lime	0·72
Organic matter	11·25
Moisture	50·00
	100·00

Natural Oxide.

Hydrated ferric oxide	70·42
Hydrated ferrous oxide	0·71
Phosphate of iron	1·89
Silica	15·25
Organic matter	9·23
Moisture	2·50
	100·00

Artificial Oxides.

	No. 1.		No. 2.		No. 3.
Hydrated ferric oxide	61·34	..	83·23	..	—
Hydrated ferrous oxide	13·69	..	10·80	..	—
Hydrated magnetic oxide	—	..	—	..	93·38
Silica	4·73	..	2·43	..	2·65
Oil	—	..	—	..	0·74
Carbon and organic matter	—	..	—	..	2·52
Organic matter	7·74	..	1·24	..	—
Carbonate of lime	—	..	0·28	..	—
Moisture	12·50	..	2·02	..	0·71
	100·00		100·00		100·00

Recovered Oxides.

	No. 1.
Anhydrous ferric oxide	33·66
Sulphate of lime	8·84
Sulphur	0·87
Silica	4·92
Sawdust	19·68
Moisture	32·03
	100·00

This is burnt spent oxide mixed with sawdust and wetted.

	No. 2.
Hydrated ferric oxide	6·94
Hydrated ferrous oxide	21·23
Phosphate of iron	1·38
Silica	6·20
Sulphate of lime	10·02
Sulphate of iron	5·08
Organic matter	21·73
Moisture	27·42
	100·00

	No. 3.
Hydrated ferric oxide	33·84
Sulphur	1·35
Sulphate of lime	8·62
Carbonate of lime	4·38
Organic matter	10·83
Moisture	40·98
	100·00

	No. 4.
Hydrated ferric oxide	15·86
Hydrated ferrous oxide	7·55
Phosphate of iron	1·28
Silica	2·51
Carbonate of lime	16·61
Organic matter	17·19
Moisture	39·00
	100·00

To users of oxide it should be pointed out that the purifying value of an oxide depends more on the state of hydration than on the high percentage of oxide of iron. That is to say, an oxide may be very rich in oxide of iron and yet be a very bad purifying material; while, on the other hand, an oxide of a much lower percentage of oxide of iron may be a much better purifying material. To prove this the author made the following experiments: 1. He mixed hydrated ferric oxide with sawdust and water, and then passed 2000 cubic feet of foul gas through it, and found it took up 8·6 per cent. of sulphur. 2. He mixed anhydrous ferric oxide with sawdust and water, and fouled it under exactly the same conditions as before, and found it took up 1·7 per cent., or only one-fifth of the amount taken up by the hydrate in the same time, and under the same conditions. 3. On trying the same experiment with phosphate of iron (a form in which the oxide of iron is found in some natural oxides) he found that only 0·6 per cent. of sulphur was arrested, or one-fourteenth of the amount taken up by hydrated ferric oxide.

Time has not permitted him to take tests of samples of the different limes offered, besides which they are so many and various that it would be extremely difficult, and would serve no useful purpose if this information were supplied. However, two samples are given as a basis and also the analysis of the spent, to illustrate the results obtained when working oxide first and lime afterwards, of which system the writer has had considerable experience prior to coming to Walsall.

Lime.

	No. 1.		No. 2.
Lime	89·60	..	92·00
Silica	0·99	..	0·55
Alumina	0·92	..	0·92
Magnesia	1·02	..	0·11
Water of hydration	7·47	..	6·42
	100·00	..	100·00

Spent Limes.

	After Oxide.		Before Oxide.
Carbonate of lime	69·73	..	67·05
Sulphate of lime	3·50	..	0·97
Calcium hydrate	6·68	..	2·40
Silica	0·28	..	1·13
Moisture	19·81	..	19·50
Calcium hydrosulphide	—	..	5·50
Oxide of iron and alumina	—	..	3·45
	100·00	..	100·00

From this it will be seen how far it is possible to work up the lime to its fullest extent as a carbonator.

With regard to the analysis of spent lime, generally this would be also exceedingly difficult, on account of the varying positions in which the lime is placed, and also of the very variable character of the material. The author has, however, been able to secure the analysis of spent oxide from different works, showing the cases in which proper purification has been carried out, and also in works where due care has not been exercised in maintaining proper condensation, washing, and scrubbing, whereby the action of the material has been seriously affected, besides the loss of bye-products for which no value is given, but which might have been recovered had the washers and scrubbers in front of the purifiers been properly looked after.

Spent Oxide.

	Good Purification.		Bad Purification.
Sulphur	52·22	..	24·47
Prussian blue	7·97	..	5·44
Sulphate of ammonia	0·72	..	11·17
Sulphocyanide of ammonia	0·07	..	0·25
Sulphate of iron	0·24	..	1·04
Tar	0·27	..	—
Tarry matter and naphthalene	—	..	3·60
Hydrated ferric oxide	21·76	..	13·19
Silica	2·29	..	6·34
Sulphate of lime	2·12	..	2·20
Organic matter	9·82	..	18·87
Moisture	2·52	..	13·43
	100·00	..	100·00

Here the oxide is made to do the work of scrubbers and washers as well as the purification; and, in addition, it is being spoilt by tar and naphthalene. So that, although it

only contains 25 per cent. of sulphur, it is practically spent —that is to say, unfit for purifying purposes.

The size of purifiers considerably influences the cost of purification, and the duty-power of the material. In a great number of cases this is not properly studied. Hence the difficulty of maintaining efficient purification, and also the loss of gas and decrease in the illuminating power by the too frequent changes of boxes, and likewise the constant source of worry of back-pressure in the winter. And if due attention is not paid to the proper dimensions of the purifying area, a very important factor is lost sight of in not giving sufficient length of contact with the purifying material. The author has found from experience that it is far better to have an excess of area than too little. In the one case the gas is passed too rapidly and does not allow the material to perform its function; and in the latter case the whole of the material is brought into intimate contact with the gas. The figure he has adopted has been about 430 square feet per million; and the depth of material must be regulated by the condition of the seal or lute and other apparatus.

When working with either lime or oxide, it is an economy to have a sufficient number of boxes, as a foul box will do a considerable amount of purification long after it has commenced to pass some of the impurity which it is intended to arrest. In the case of lime, this is well illustrated by the accompanying analyses:—

Spent Lime after Oxide.

	Bottom Layer.	Middle Layer.	Top Layer.
Carbonate of lime	66·16	56·18	44·91
Calcium hydrate	12·91	16·09	20·96
Sulphur	—	—	0·24
Silica	0·25	1·23	1·96
Cyanogen	0·25	0·14	0·07
Moisture	20·43	25·36	31·86
	100·00	100·00	100·00

Here it will be seen that the box has been thrown out of work long before the lime has become totally spent. Had there been an additional lime-box after it, this lime could have been worked up until practically the whole of the material had carbonated, instead of leaving 50 per cent. of the available lime unacted upon in the top layer. This likewise applies in the case of oxide.

Too much care cannot be taken in the slacking of lime. Avoid making it too wet and lumpy; and, on the other hand, if the lime is not properly hydrated, the quicklime will not work.

The revivifying area for oxide should be arranged to suit the quantity of material used, which ought never to be of a greater depth than 6 inches on the floor; and care should be exercised in keeping up the proper percentage of moisture, and not allowing the material to get too dry or even too wet. This depends somewhat upon the kind of oxide used, and how far spent.

In the course of the writer's inquiries, he has naturally been asked for information as to his opinion of the most economical and efficient method of purification. In some cases he has replied; but he has purposely avoided committing himself to an opinion in view of writing this paper. After all, the question of which is the most suitable material to use resolves itself into this: Whether one is under the sulphur clauses; what purifying area one has at command; and what facilities one has for disposing of the spent material. If under the sulphur clauses, there is no option but to use lime, with catches of oxide or Weldon Mud. If one is not under the sulphur clauses, and has a sufficient number of boxes, then oxide first and lime afterwards, because oxide used before lime is generally more valuable on account of the cyanogen compounds, besides the sulphur it also takes up; whereas in using lime first, the cyanogen is lost, and only a portion of the sulphur is obtained in a marketable form; and last, but not least, the difficulty of disposing of the foul lime.

For those who are not favourably placed with regard to sufficient purifying area, it would be advisable to obtain additional boxes; otherwise the imperfect system of purification will always remain costly and unsatisfactory. The secret of success in every stage of purification is to ensure that each apparatus performs its own duty, and is not allowed to throw a portion of its work upon other parts of the plant.

The views that the author has put forward in this paper are the result of a somewhat long and extensive experience under varied circumstances; and they will, he trusts, be of use and interest to many, and lead to healthy discussion.

Discussion.

Mr. J. D. Ashworth (Portsmouth) said he could not allow the subject before the meeting to pass without making some observations. As to condensation, he considered the better method was to remove the tar from the gas as quickly as possible. As to scrubbing and washing, mention was made of the scrubbers doing the work of the washers. This, he presumed, was the taking out of the last traces of the tar. When he first went to Portsmouth, he had considerable difficulty with the purifying plant. His first duty was to re-instate some Livesey washers which had been altered to another form. He found the scrubbers were not only blocked up with tar, but it had made its way into the purifiers, and there was considerable difficulty and annoyance in regard to back-pressure. He brought the Livesey washers into use again in their original form. As to the method of working the purifiers at Portsmouth, they used lime first and oxide afterwards, and the results were very satisfactory. For the six months ending in December last, their sulphur compounds averaged 7·3 grains per 100 cubic feet. The carbonic acid was, of course, extracted; and the labour came to 0·23d. and the materials to 0·21d., or about ½d. per 1000 cubic feet. The worst of it was that they had to pay an enormous price for lime. Referring to oxide, he might mention that with his carburetted water-gas plant he was using oxide of iron; and to prevent it being spoilt by any oil which might get forward through inefficient manufacture, he had breeze put all over the bottom tier in the purifier. This prevented the oxide being spoilt, and left it in a saleable condition. With regard to water added to the oxide, he had known experiments to be made which showed as low a percentage as 9 of water. But he used 35 per cent.; and he found then that the efficiency of the oxide for removing the impurities was all that could be desired. As to the remarks on the large area of purifiers, everyone knew that the boxes could not be too large, if it was desired to get out the impurities in a satisfactory manner.

Mr. C. C. Carpenter referred to the analyses of lime as given in the paper, and said he found that no return had been made of carbonate of lime, and he thought the lime referred to could not possibly exist in the form mentioned, speaking commercially. He imagined the return of carbonate of lime would be about 7 or 8 per cent. Although he knew that oxide of iron had been used on the Beckton system, he was not aware that it had been employed in conjunction with the working of lime in rotation. The London restrictions were very severe; and, owing to the considerable trouble they had experienced from time to time, they laid out their last section at Greenwich by adding to the boxes in rotation another box containing oxide of iron. This was put in in four layers, each being provided with one of Cripps's valves, so that, in the event of there being a block up, the tier could be bye-passed. Normally, the conditions were that the sulphuretted hydrogen and the other impurities passed, with the slight reduction due to whatever proportion of air might be going forward from the retort-house. The object in using it was twofold. If systematic tests were made, and there was a considerable drop in the sulphuretted hydrogen, this would indicate that something was wrong on the vacuum side of the works, which would require rectification. Instead of the lime being rendered inert in the purifiers by the sulphur, when its turn came to be dealt with by carbonic acid it was fixed in the oxide box. Then there was the advantage which Mr. Smith had pointed out, that cyanogen was very largely recovered in the oxide box. As to the size of the purifiers, he was not in agreement with the last speaker, who said that it was immaterial how big they were made. In dealing with large boxes, it was difficult to get the same value per yard of lime as was the case in smaller works which did not possess nearly the same purifying area. He had experimented, and had divided the boxes up into sections; and, in accordance with the make of gas, one, two, or three sections were put into operation. Taking a section as equivalent to 6 million cubic feet per day, each box should account for 2 millions.

Mr. Smith: What is the size of the boxes?

Mr. Carpenter: About 72 feet by 30 feet. If they made 6 million cubic feet of gas, all the boxes would be used; if 4 millions, two of the boxes, or two-thirds; and if 2 millions, one box, or one third. The question of the proportion of plant to the work was very important. If a box of (say) 430 feet was the right proportion per million, this would only be for a certain make of gas. It was well known that the makes of gas varied very considerably in summer and winter,

and it followed that there ought to be some means whereby the proper proportions of plant should be used.

Mr. ASHWORTH said that he was not an advocate for boxes of large size, but he certainly did believe in having a large purifying area. In his own case, in his summer make he shut off one section, and as the winter approached he put on another—thus making two streams of gas. He quite endorsed Mr. Carpenter's statement that boxes, when too large, were a great disadvantage.

Mr. H. IAGO (Fulham) said, in reference to the size of the boxes, he had found exactly the same condition of things as Mr. Carpenter. It being necessary to increase his purifying area, he enlarged the size of the boxes, this being cheaper. He would draw attention to the fact that, in too large an area of purifiers, the sulphur became unmanageable. He had come to this conclusion because he found that too small a quantity of gas was going through. As to the cost of the purifiers, it must vary, as members knew, with the conditions under which the work was done, the price of lime, the position of the works, the difficulty or otherwise of getting material, &c.

Mr. T. GLOVER (West Bromwich) said, with reference to Mr. Smith's remarks as to the quality of the oxide, he could not think that the material was in the condition in which it had been removed from the purifier. It seemed to him to be rather too low. Then, again, going back to the analyses relating to bog ores, he thought the oxide ought to have been doing more work. As to the sulphur, this was high simply because the moisture was low. On the subject of the removal of sulphur compounds, he was of opinion that sometimes when they tried to reduce them to what ought to be a very low percentage, they failed, and they could not get at the reason. He thought the author had made purification his special study; and he (Mr. Glover), for one, would like to have heard more about it, as well as something on the subject of the influence of temperature on the boxes. Another point which was of importance was the production of ammonia in the lime boxes by the decomposition of the cyanide compounds. This was especially important when independent tests were made. The oxide, of course, arrested the cyanide, and prevented the decomposition which afterwards took place. As to sulphur compounds, he knew works where they were extremely low.

Mr. G. S. SAYNER (Harrogate) asked for information as to the most inodorous method of purification—whether with oxide or lime, or both combined—of course, without loss of efficiency and in point of economy. Considering the conditions of a health-resort, one desired to know something upon this point.

Mr. S. GLOVER (St. Helens) said his experience had been with lime only. His boxes, which consisted of four in each set, equalled 500 square feet per million cubic feet of gas per day; and by the thorough mixing of the lime and their method of putting it into the boxes, they obtained very efficient results indeed. As to sulphur, they produced gas having not more than from 7 to 9 grains per 100 cubic feet. They very seldom got more than a grain of ammonia in this quantity of gas. The boxes were operated four in each set, and they were not changed until the third box showed traces of sulphuretted hydrogen passing. The whole worked very smoothly and simply, and was not so complicated as might be imagined.

The further discussion of the paper was adjourned until the next morning.

The PRESIDENT, resuming the discussion, said he thought they might, with advantage, ask Mr. Smith for his reasons for adopting Green's system of purifiers; or, if there were any members who had experience of the system, it would be a good thing if they would give it, as there seemed to be considerable difference of opinion on the matter. He had given some attention to it himself, and had found that the difference in the structural cost of a very large establishment was only 12½ per cent.; but, considering that labour was much more expensive than the laying out of capital, he came to the conclusion that he would lose money in the long run by adopting it. In addition to that, they lost the advantage of that most effective safety-valve which the water-lutes of the purifiers gave on the occasion of any stoppage of a series or obstruction in the system. With regard to another very important question, as to the size of the purifiers in relation to the work to be done, there was no doubt that the pressure given by a purifier was in inverse ratio to the quantity of gas passing. Without pressure, it was impossible to get an efficient purifier. If the quantity of gas passing through the material was so small that it offered practically no resistance, the gas, in a sense, percolated through, without any chemical change taking place; hence the reason why an excessively large box was not so economical in the use of material. It was therefore important to limit the size of purifiers, particularly when dealing with a summer make as compared with the maximum winter make.

Mr. J. W. HELPS (Croydon) said the Institution had not been favoured with a paper on purification for some time past; but this one bristled with points on which it would be so easy to hang remarks, that the discussion might be easily continued for the whole morning. He would, however, endeavour to be as concise as possible. It might seem to an outsider somewhat strange that for so many years practically no alterations or improvements had been made in the method of purification. They had rung the changes upon lime and oxide, with an occasional use of Weldon Mud; and that was as far as they had gone. This might arise from one of two reasons. Either they were perfectly satisfied with their present methods, or they were unable to find better ones. But, after all their experience of these methods, they were unable to describe them as absolutely satisfactory; and he thought there must be some reason for this. If at one time lime and oxide, when used in a certain way, were capable of giving perfectly satisfactory results, why was it not so at another time? This arose from the conditions under which the purification was carried out, which changed from day to day and week to week. The composition of the gas varied, and also the quality of the purifying material and the way in which it was prepared. The variation in the composition of the gas arose in many ways; and, first, from the difference in the coal used. Where a manager had to deal with coals which gave practically the same amount of sulphur and sulphur compounds day by day, that difficulty had not to be faced; but this was not often the case. In his own works, he used principally two coals, one of which would give perhaps 600 grains of sulphuretted hydrogen and 30 grains of sulphur compounds at the inlet of the purifiers. The next day a cargo would come in which gave 1000 grains of sulphuretted hydrogen and from 40 to 50 grains of sulphur compounds. This in itself made purification somewhat difficult. But there was another reason why the composition of the gas varied; and he was inclined to think it was not generally realized, or did not receive sufficient attention. That was the manner in which the composition might be varied in the retort-house. Whenever any trouble occurred in the purifiers, the first thing he did was to go to the retort-house; and not infrequently he found that they had been getting a little thick tar in the hydraulic main, and consequently unequal seals, and with a constant vacuum they had been pulling in not only air but furnace gases. Of course, at once up went the sulphur compounds. At Croydon, they followed what was generally described as the rotation system, using four boxes of lime in rotation and then an oxide catch-box. He had lately put down on the Green principle a large catch-box, in which he was going to use Weldon Mud. Mr. Smith had given a lot of useful information with regard to the composition of various oxides; but he should like to ask him if he had yet found an oxide which was capable of dealing in the final catch-box with the smallest traces of sulphuretted hydrogen. If he had, they would all owe him a great debt of gratitude. He must say that he had never found one which would deal with those final traces. In many works not under the sulphur clauses, where testing for sulphuretted hydrogen was not carried out as it sometimes was in London—where the managers were expected to keep their gas so free from it that 10 feet of gas impinging at a very slow rate on bibulous lead paper would not discolour it in twenty hours—this system of oxide catch-boxes might be satisfactory; but he had found it impossible to remove these slight traces with oxide. The small space of 1-16th of an inch or a little more on which the gas might impinge would be discoloured with a trace of sulphuretted hydrogen which could not be measured, and which made him sometimes think that the test imposed upon gas managers was almost absurd. For some time past, they had been using Weldon Mud in the final catch-box; and he could not speak too favourably of its action. Again, with regard to the purifying material itself, questions had been raised as to the degree of moisture which should exist in the oxide—one speaker saying it should contain a fairly large proportion of moisture. His experience was that the moment one got anything above 10 or 12 per

cent. of moisture, the purification suffered; and if one wanted the oxide to be properly active, it should be kept fairly dry. He had not found it impossible to sell oxide of iron containing as low as 4 to 5 per cent., as it came almost direct from the boxes. With regard to lime, an important point was that it should be slaked as long as possible before it was used. Years ago, when he first entered the profession, he was taught to use lime freshly slaked. But on going to another works a few years afterwards, he was surprised to find that they took in a large quantity of lime, slaked it, and stored it for months; and since then he had, so far as possible, adopted that principle. The slender coating which formed on the outside was absolutely harmless. The proper place to slake lime was outside the purifier, not in it. If the latter were done, it would to some extent account for the patchiness one sometimes found in lime-boxes. When the oxide was very dry, it was apt to fall through the grids; and to prevent this, matting was sometimes used. He would ask Mr. Smith whether he found that this matting, if carefully cleaned, occasioned any appreciable back-pressure.

Mr. Livesey said he was not fortunate enough to hear the paper read, but he should like to emphasize one remark made by Mr. Helps with regard to the test for sulphuretted hydrogen which had been in use in London for something like twenty years—a stream of gas being passed on to lead paper. As the regulators of the purity of London gas, they had three very eminent scientific men, Fellows of the Royal Society, and they went on the principle that the Act of Parliament said there was to be no sulphuretted hydrogen in the gas. They knew, of course, that a very small quantity of this impurity would rapidly discolour lead paper; but as the Act of Parliament specified that there was to be none, that was the reason, as he understood, why they had devised this brutal test. He believed it would discover 1-10,000,000th part. At any rate, he could speak from experiment that 1-1,000,000th part was rapidly shown on the lead paper. A few days previously, he was calling upon a gentleman engaged as an expert in the investigation of arsenic in beer—his business being to inquire as to the effects of arsenic in coke. This gentleman, who was a man of eminence in his profession, remarked that the Royal Commission would have to say how much arsenic might be allowed in the beer—that they would have to put a limit on it. To say that beer was to have no arsenic at all was impossible; there must be some limit allowed. Now, if arsenic was to be permitted in beer, there certainly ought to be some minimum of sulphuretted hydrogen allowed in gas.

Mr. D. H. Helps (Redhill) said one way of looking at the question of the test imposed on many gas companies for sulphuretted hydrogen was this: The limit to sulphur compounds, of course, varied. Taking it in winter at 20 grains, this only amounted to 0·09 of the weight of 100 cubic feet of gas, which was about 22,000 grains. If such an amount of sulphur compounds as this was allowed, it seemed ridiculous to limit the sulphuretted hydrogen in the way it was. With regard to the area of purifiers, it had been said on the previous day that it would not do to have them very large. He should not say, except from a constructional point of view, that the area mattered very much, provided that there was sufficient gas passing per superficial foot of the purifier. In some works the purifiers were much too large in the summer time, simply because the material was not kept active enough, owing to the small quantity of gas passing. He should be glad if Mr. Smith could give the figures for the Green system of purifiers.

Mr. T. Holgate (Halifax) said he had recently erected some purifiers on the Green system; but as they had only been in operation for three months, he was unable to say what the working charges were likely to be. Some information might, however, be useful as to the method of construction they adopted. He would therefore make a rough sketch of it on the blackboard. The purifiers were 57 ft. by 38 ft. by 10 ft. The gas was admitted to the middle of the box; and one portion traversed the upper section and the other the lower section. On each outlet a valve was placed, so that if there were any tendency to inequality in the gas it might be corrected by closing, more or less, one or other of the valves; but up to the present they had not found any necessity at all to touch them. The gas was passed with a fair degree of equality through each section. The reason for adopting this construction was that the floor area was restricted; and in order to get the necessary capacity, they had to adopt the method of practically making two purifiers in one. The space underneath was reserved for receiving the spent lime or oxide, and a third floor was provided above the purifiers for the lime and oxide; so that by having a canvas shoot, the boxes could be filled. They found some little difficulty in making the covers tight. Each box was fitted with six covers; and they were advised by those having experience that a rubber joint $\frac{1}{8}$ inch thick would be sufficient. They put in a $\frac{1}{4}$-inch, and found it would not do; but by using a $\frac{3}{8}$-inch rubber ring they had been able to get a perfectly tight joint. In one purifier they adopted a somewhat different shaped ring from the ordinary kind, rather more conical than flat in section. When the pressure was applied, it seemed to embed itself better into the surface of the box; and it made an absolutely tight joint. They found the cost of construction much less by the Green system than by the ordinary method; and to meet the question of an escape-valve when pressure arose, they fitted on the inlet-pipe coming to the purifiers a branch having on it a valve and seal pot, so that in case of any stoppage the gas had only to pass out at the pot. Of course, it was put in such a position that no damage could arise from an escape. The great advantage, perhaps, was in the strength. It being made with a closed top, the sides were immensely strengthened. The cost of the lifting tackle was also very much reduced. He was not able at the moment to give the cost in proportion to the capacity; but in an article by Mr. Fletcher Stevenson in "Feilden's Magazine," he gave the figures, in which he showed that the cost of these purifiers was the lowest he had found anywhere—referring not only to the ordinary system, but to others that had been constructed on the Green principle.

Mr. A. F. Browne (Vauxhall) said he was disposed to agree with the opinion that boxes might easily be too large; but he certainly was not convinced that, from a chemical point of view, they could be too small. The real difficulty in a small box was the fact that at times, with water-lutes, the boxes blew; and they did not always choose the most convenient time for the purpose. He was rather surprised to hear the President say that the water-lute was desirable from the point of view of the safety-valve. It all depended upon where the purifiers were situated. If they were in a covered building, it was hardly the place for the purifiers to blow. He had often wondered to what pioneer of the gas industry they were indebted for the hydraulic joint for purifiers. They required the automatic joint in the case of the gasholder and the water-sealed pendant; but why a variation of a few ounces per square foot in the pressure in the boxes should call for an automatic joint, he could not see. In a very interesting paper recently read by Mr. Jones,* he spoke of a method in which a joint was now made by bolts at the edge, and in conjunction with which he strengthened his cover by holding-down bolts to spread the resistance over the whole area. Another point of some importance was the use of atmospheric air in purification. For a good many months past, he had been experimenting at Vauxhall on the amount of air normally present in the gas. He found that it was almost impossible to keep the whole of the oxygen out; and his average at the inlet of the purifiers was 0·3 per cent. It used to be a good deal more; but with this amount he found there was no appreciably bad effect upon the purification, though he must admit that with 0·2 per cent., which he sometimes got, the purification might be better. At present, however, he rarely succeeded in getting it below 0·3 per cent. This pointed to the necessity of using every possible means to prevent the drawing in of air; and he therefore cordially agreed with the remarks made by Mr. Helps that morning. They knew that the use of oxygen was desirable in lime purification; but the vacuum side was not the proper place to introduce the air, even though it could be a measured quantity. They found that the place to use atmospheric air in connection with lime purification was in the box into which the sulphuretted hydrogen was freely entering, and sulphide was being formed, and where carbonic acid was absent. It was at this point that the introduction of air very much promoted the chemical action, and raised the temperature; and, under these circumstances, they found the sulphide formed and became active. It was not an uncommon thing at Vauxhall, when changing the first lime-box in the rotation of four, to find the sulphuretted hydrogen entering the oxide-box to run up from 100 or 200 to 400 or 500 grains. The new box on being charged was placed in rotation; and the large quantity of sulphuretted hydrogen entering it with a suitable quantity of air, sulphide was formed immediately, and the

* See "Journal" for April 23, p. 1055.

chemical action was so rapid that it was not uncommon for the sulphur to fall even 10 grains within an hour or two at the outlet of that particular box. It appeared to him there was great advantage in placing lime purifiers in a covered building, if only for the convenience of keeping up the temperature. He had one set entirely enclosed, and another which was shielded, but open at the sides; and they found in the winter the purification of the set within four walls was much more regular than that of the other. He might add that the quantity of air they found most suitable was 0·5 per cent. of the volume of gas in the lime vessel; and an additional quantity of about 1 per cent. in the oxide vessels kept them right. They all agreed that oxide of iron such as they were able to procure, would not deal satisfactorily with the last traces of sulphuretted hydrogen in gas; but if one used a sufficient quantity of air, it was surprising what a great deal of service was done. With regard to moisture in the oxide, he thought Mr. Helps had gone to the extreme in reducing moisture, because, while he had no doubt it was desirable from the point of view of getting rid of the waste product, he was disposed to think that a little more moisture (anything short of about 20 per cent.) did not hinder the chemical action. They got into the habit of judging of these things more by the eye than anything; and he found that if the oxide had a blue tint it did not do as good work in the purifier as if it were a chocolate brown, which colour it assumed with about that quantity of moisture.

Mr. W. J. A. Butterfield (London) said he could give a little definite information, if it were desired, as to the delicacy of the test for sulphuretted hydrogen which had been referred to. Some few years ago, in connection with an alleged nuisance in a gas-works, he had occasion to ascertain what proportion of sulphuretted hydrogen in the air would discolour lead paper; and he found a distinct discoloration when there was 1 volume of sulphuretted hydrogen in 12,000,000 volumes of air, and a very distinct stain indeed when it was 1 in 1,000,000. If the air had been replaced by gas, no doubt the stain would have been deeper, as the air would have been oxidizing the sulphide. The lead paper was moistened; and it was exposed for about twelve to sixteen hours. Some years ago, he pointed out that no test for sulphuretted hydrogen at present in use was so delicate as it might be. As all gas managers were aware, it was quite possible to devise a stricter test than any now in vogue. But it was manifestly absurd to ask for gas to be perfectly free from sulphuretted hydrogen or any other impurity; and any Act containing such a clause needed amendment.

Mr. E. A. Harman (Huddersfield) asked at what temperature Mr. Smith found it most desirable to conduct the revivification of the oxide. They all knew from experience the great difference between the revivification of oxide in the summer and winter months. Below 60° it was far less active than above that temperature, and in frosty weather it was next to impossible to get the oxide revivified at all. One might turn it over and over again many times, with very little result indeed.

Mr. Smith said the discussion had been very satisfactory to him, and quite rewarded him for any pains he had taken in preparing the paper. As he had explained, his object was to elicit information quite as much as to convey it; but he would endeavour to reply, as well as he could, to the questions which had been asked. The number of answers he had received to his inquiries was so great that he had been unable to give as much information as he should have liked; but the majority were in favour of using lime. The question hinged entirely on the position in which one was placed. Lime, though purchaseable much nearer, might not be as cheap as oxide at a long distance; and there was sometimes the difficulty of getting rid of the spent lime. He had avoided mentioning the cost of purification, because it depended so much upon local circumstances. The temperature in boxes should be as evenly maintained as possible; hence the advisability of putting the boxes under cover. He had had experience for some years of boxes in the open, and had as great difficulty in keeping them cool in summer as he had in keeping them at the proper temperature in the winter. The reason he had adopted Green's system was on account of the structural arrangement of his purifier-house; but he should still adhere to it after experience, because the cost of labour was such a serious matter, and with a view of dealing with that he had adopted the method of discharging and charging the purifiers by machinery. He was not aware that at present this was done at any other works. With regard to the safety-valve difficulty, this could easily be overcome in the manner Mr. Holgate mentioned, by putting in a seal-pot; and the question of blowing was easily checked by means of pressure-gauges. There should be a full set of gauges in the engine-house. The pressure did not pop up immediately—it increased gradually; and precautions could then be taken to relieve it or bye-pass a portion into another purifier. He was unable to give any information as to the cost of Green's purifiers, because he was still in the early stage—in fact, he was only now having the boxes erected. He quite agreed with Mr. Helps with regard to the moisture in the oxide and the slaking of the lime, which was most essential. It should never be used directly it was slaked. When he got in a truck-load of lime, he made a hole with an iron bar, and put down a 2 or 3 inch iron tube, with an india-rubber tube attached, and allowed water to run right into the centre of the lime. The steam coming up gradually slaked the whole of the lime down to complete flour. Then in opening up the lime afterwards to cool it, one could add a little more moisture if required. He found this a much better way than raking the lime down and pouring water on it, because so much area of lime was lost by the formation of balls. The moisture in the oxide he had always maintained was a very important matter. As the oxide became spent, it was easy to gradually withdraw the water, and thereby to enhance the value of the material by selling it with very much less moisture; but while in active operation, the moisture should be maintained according to the activity of the material. He had made some analyses of bog oxide, and one of natural oxide. In one case, the hydroferric oxide was 21·78; while the natural only contained 0·2 per cent., with 46·49 per cent. of silica, 0·12 per cent. of organic matter, and 35 per cent. of moisture. The oxides were really sent in in an indifferent form, and varied much from time to time; so that all parcels should be carefully examined before purchasing. It had been said that the quality of gas varied from time to time. He had had experience of both a hydraulic main and a dry main; and no doubt he was liable to have more air than those who used hydraulic mains, from the fact that, if the pull only varied (say) half of one-tenth of either vacuum or pressure, if the furnace gases were in excess of the quantity of gas in the retort, there was liability to have furnace gases introduced. But this applied equally to retorts worked with hydraulic mains, and he thought to even a greater extent than with dry mains. The whole thing hinged upon the quality of the gas itself. He was in the habit of using eight or nine different kinds of coal; and it was utterly impossible to draw a fine line as to the class of purification requisite for each kind. It was well, therefore, always to have ample purifying power. It was a difficult matter to regulate, except in the manner suggested by Mr. Carpenter, of having the boxes sub-divided; but he feared this would be rather a costly process. In his works, they were not under the sulphur clauses, and therefore were not so particular about it; but with regard to the last traces of sulphuretted hydrogen, the whole trouble lay in the oxide as a catch-box being killed by the moisture thrown off from the previous boxes. The lifetime of a catch-box was considerably greater than that of an ordinary purifier; and the moisture was gradually driven forward and collected in the catch-box. This was the secret of the catch-box gradually losing its efficacy. With regard to revivification, they all knew that in foggy weather one could not revivify oxide in the same way as on a bright day. There was no doubt that the action of light had considerable influence on the colour; but colour was no criterion, because it varied according to the kind of oxide—whether it was natural oxide, bog ore, or artificial oxide, which had its own colour—and it was only by practice and careful observation one could learn to distinguish them. He thought 6 inches should be the maximum depth, and the material should be turned over rapidly. He always considered that the oxide should remain outside for four or five days, according to the quantity in use. It was far better to revivify in the open than in a covered shed, except, of course, in snowy weather. The water which it took up was only proportionate to its porosity, or to the amount of anhydrous matter in it. If a quantity of spent oxide were stacked, it was exactly the same as slaking lime. It was only the skin which was covered with excess of moisture or carbonic acid. With regard to the use of air in purification, he had not made any reference to it because he read a paper on the subject some time ago; but no doubt great benefit was derived by the use of air in preference to oxygen.

Mr. Browne said he thought they were all agreed as to the necessity of a safety-valve, and there could be no better

safety-valve than a hydraulic one. The question was where it should be placed. The one Mr. Holgate had sketched would be very well a quarter-of-a-mile away, in a field; but he should prefer to take it up to the highest point in the works, and let it go to Heaven if it would.

Mr. SMITH said he thought Mr. Holgate only drew the valve to show that there should be one.

COMMUNICATED ARTICLE.

GAS MATTERS IN THE UNITED STATES.

A New Incandescent Burner.

In my last letter, I informed you of my impressions in regard to a new burner. I have just seen another which incidentally shows a new way of using fabric. What think you of this? The ordinary mantle is 1¼ inches in diameter at bottom, ½ inch in diameter at top, and is about 6 inches high. It has, then, an area of about 18 square inches, which, multiplied by 10-candle power (its best average performance), gives 180-candle power as what it may be expected to do, and what it actually has done, *crede experto*, both with a Sugg burner and also with the arc which, for need of a better name, I shall call the Kalamozoo burner.

With this new burner, the same average performance of 10-candle power per square inch works out thus: Diameter of incandescent curtain 6 inches, height 8 inches, area of incandescent surface 144 square inches, which, at 10-candle power for each square inch, is 1440-candle power. There was no chimney, but a large globe. There was no sensible difference between this light and that of an equal volume of light from an ordinary mantle. The mantle did not seem to be superheated, as one man said it did not look hot. While it was fully up to the measure on the photometer, it did not have the relative actinic efficiency. This, presumably, was because of the materials used. The inventor said that, owing to the possibility of employing enormous pieces of fabric, and the exceedingly trifling difference in the cost, both in gas and in fabric, he proposed using a mantle giving only about 8·7-candle power per square inch of surface.

In passing, it may be mentioned that some very elaborate experiments have been made here this winter on the radiating power, per square inch and per square centimetre, of a large number both of mantles and mantle fabrics. The figures will probably be communicated later to some Association; but for the immediate present, the man who paid for the making claims the sole use of the information obtained.

In addition to the above burner containing a square foot of illuminating surface, a large flat surface of one square yard was displayed. The effect was simply bewildering; and at the distance —only about 20 feet—the emphatic remark "diabolical" seemed not unsuited. I think a few minutes more would have made us permanently blind. We endured the light less than three minutes, and were calling on our host to extinguish it when he did so. Three hours after I was still suffering from the experience, as was also another of the witnesses of "what a man can do in the way of a gas-lamp, when he really tries."

Photographic Plates and Incandescent Gaslight.

Mentioning the effect of this on the eyes reminds me of a phenomenon noticed during the X-ray excitement, and which has reappeared in connection with the Sugg and other high-power burners using mantles. I referred to it during the X-ray period in an address and also in a contribution to a scientific journal. I allude to the penetration of substances ordinarily opaque by actinic rays. The plate-holders of a camera belonging to the maker of these extravagant lights are marked with a number and the word "exposed." This word was stencilled on with "Canada balsam" and then rubbed in with graphite, so that in the dark one can easily distinguish the two sides by the "feel" of the word. The inventor says that, although these plate-holders perfectly protect Cramer's ortho-chromatic plates from sunlight and from fabric lights under usual conditions, they do not protect from the Sugg nor the Kern burners—or rather from Welsbach mantles of a certain number, which is known, when heated by these burners. If I correctly understand it, the Welsbach people find themselves unable to explain the circumstances; but I believe it a phenomenon which will open up a new field.

It must be understood that any discussion of this phenomenon must be perfunctory; and yet the subject is of such enormous importance that any amount of time occupied in speculation and study seems to be justified.

New England Association Meeting.

While the members did not, at the recent meeting of the New England Association of Gas Engineers, show the intensity of attention which might have been expected, the papers were in some respects unusually interesting; and while most of the members seemed to think the meeting a fine chance to have a good time, others regarded it as an opportunity to improve their minds. The President's Address contained less of "bunkum" than is usual, and was really ideal, in its total want of colour, like a sheet of Whatman's "note-paper" washed with a *very light wash* of Payne's Grey and then "blotted out" with pure water. It was without form and void.

The first paper was one on the works in Springfield (Mass.), particularly their way of handling their "boxes." The writer stated his great personal satisfaction at the working of the plan adopted for mixing air with the gas before sending it into the purifiers. It is his custom to mix 1·2 per cent. of "atmospheric air"—*i.e.*, 0·24 per cent. of oxygen; and he seemed to think his results almost ideal. This is an opinion which some may share, and with which others will differ.

The next paper was by Mr. C. Miller, of Newark (N.J.), entitled "The Proportion of Sulphur Removed in Each Purifying Box." This paper was regarded as utterly contemptible and as perfectly without excuse by the "practical men." But the few trained chemists present regarded it as of the utmost importance. It would give me pleasure to quote parts of it in full. Mr. Miller found that, with coal gas, using the regular (four box) practice, the sulphur was removed in nearly the same amount in the first two boxes. The averages were: First box, 44·6 per cent.; second box, 44·2 per cent.; third box, 10·4 per cent.; and fourth box, all there was left—0·8 per cent. This left the gas quite clean. When Mr. Miller experimented with water gas, he obtained some very different results. The first box removed 57½ per cent.; and the second box 33·5 per cent. The third box removed only 7·6 per cent.; and the fourth 1·4 per cent. The very different distribution —the strange fact that the fourth box removed nearly twice as much in the case of water gas as it did with coal gas—is all the more surprising, as we find the third removed so much less. One would infer that it was the oxide, and would feel inclined to examine into the condition of the boxes. Mr. Miller did not remark on these peculiar discrepancies in his paper; and no one else mentioned them in the discussion. This brings out, and emphasizes, the fact which I have so often mentioned in relation to the papers read before this and other societies, that the chances are strongly against anyone bringing out anything in the discussion not marked by the writer in red, "Please discuss this." In the case in question, the hare started in the discussion was not the variation in the sulphur removed, but "lead test papers;" and they lost this almost immediately. Certainly it is time that the use of test papers was stopped altogether, or else that their use was put on a proper basis. Surely when there are so many accurate processes, which require only ordinary intelligence to operate correctly to within an error-margin too insignificant to consider at all, there is no need to use one of which it is said that its falsity is a bye-word.

Another paper was entitled "A Test Run of a Gas-Engine." This gas-engine was one giving power to an electric lighting plant at the "Mechanic's Fair," as it is called. No one hearing the paper read could avoid learning certain useful lessons, were he reasonably attentive; he could in no way avoid learning both the strength and the weakness of gas-engines (of this pattern) as a motive power. Personally, far more interesting did I find the error of the audience than the strange cadency of the paper. The paper recognized that these figures belonged only to this engine, but seemed inclined to carry them to other methods; while the audience, from the very first word of the paper, wanted to apply the figures, not only to all other gas-engines of this pattern, but also to gas-engines of every kind and pattern. To study the paper is to learn many things. First, one cannot avoid seeing both the strength and the weakness of gas as a motive power—the wide range in cost, due to the price in different localities, and the still greater range of variation if we estimate the cost by the price per million B.T.U. in each locality. But to discuss this question is to discuss the paper, not to write about the meeting. The paper was listened to with an attention hardly half-hearted —a weak third, or even quarter belike; and no one, so far as I could see, made any memoranda in relation to the missing data—that is the data needed to make the discussion anything more profitable than a battle with a punching bag. From the data given it appears that the average gas used contained 573·4 B.T.U. per cubic foot. Poole gives the average of the Boston gas samples—that is, averages from various works (there are even now in effect eight different "standards" in Boston)—as 658·5 B.T.U. This, of course, shows a serious falling off in quality, or at least i calorific value, since the analyses were made on which Poole based his valuation. But, bad as this is, it is nothing beside the fact that only 39·86 per cent. of the heat actually delivered to the engine is accounted for. The amount put into the dynamo averaged 17·9 per cent. The extremes were 21·1 and 11·8 per cent. In other words, the efficiency of the best ten minutes' run was almost twice the efficiency of the worst ten minutes. The natural inquiry "What can this mean?" was raised by no one. But when the men get time to study the performance, there is going to be someone who will ask the question; and if I am not much mistaken, the answer will be: "If this is the best that this type of gas-engine can do, let us know it, and let us leave this type alone; and if it was the fault of the installation, let us know that." The idea that the comparative performance of this engine was to be considered, did not appear in the discussion; nor was anyone so considerate as to compare the figures given with those of a steam-engine. The President said this trial was a proof of a cost of "3·3 c. per kilowatt," whatever that may mean. His words were: "Without doubt with the (why not "this," as it should be) gas-engine, we can obtain at least 30 kilowatts per 1000 cubic feet of gas; and with this gas at $1 per 1000, we obtain a kilowatt (which is equivalent to twenty 50-watt lamps one hour) for 3·3 c. He therefore

intended to say: "One kilowatt per hour costs 3·3 c." This is 2·34 c. per horse-power-hour, using gas costing $1 per 1000 cubic feet; or, more exactly, it is 2·34 c. per horse-power-hour when 1,000,000 B.T.U. delivered to the engine costs $1·74. Truly there must needs be improvement, before this engine can be run on even terms against a steam-engine; and there exist the data of a test-run made with acetylene for fuel in a certain make of gas-engine, which is nearly as good as this.

The Question-Box raised a discussion on a topic as it was understood by some, "Shall we work for candle-power or for cubic feet, in making gas?" This is a burning question, there is no doubt of that; and it rapidly brought into evidence the feelings quite as much as the thinkings of the members. The discussion was sharp, very sharp indeed—almost bitter—between the most advanced circle and the most conservative. The radicals reminded the members of the importance of the mantle; the ultra-conservative, of the importance of the trade which knows it not. The very next topic blew the embers of this superheated discussion again into a flame. It was this: "Is the incandescent gas-burner in sufficiently general use (in Boston?) to justify us in returning, in going back, to 17-candle gas?" The same member who had made the previous topic interesting, if no more or less, ensured this one holding everybody's attention at least for a time; but the gentleman who said: "If we made a 17-candle gas, we would decrease our custom to one-third, and would make the electric light company a present of the other two-thirds, in fact, of the business," seated himself in the midst of applause, as if it were believed that he had put the case fairly.

The next paper was "A Study in Gas-Governors." This, illustrated by numerous diagrams, showed very plainly the development from the earliest recorded time to the present day. The fact that there were errors, had no effect on the discussion. The gas might go to the left in the diagram, and to the right in the machine; but the discussion went straight ahead just the same. Every member had his choice among the forms described. It was a most amusing state of things. Each man had a favorite governor for all work as well as for each special kind of work; and (it was useless to gainsay it) the feelings as well as the thinkings of the members were becoming engaged in the discussion, when the President very wisely stopped all further words by turning to the next item.

The morning session of the second day was the chosen opportunity for the regular discussion of: "How can we Manage to Sell More Gas?" This time it was opened by a paper entitled "Selling Gas." In this very readable, and also think-about-able, paper, the writer challenged the usefulness of, it seemed, all known methods, and offered no new ones in place. This is an unusual way of doing the thing; for usually the man who brings this matter before the Society stands provided with a nostrum. But the paper set men talking. The writer of it seemed inclined to play the pessimist. One man suggested that he was out of health; another that, not having anything new to say, and having taken up so much time, he was not a little conscience-smitten. The discussion could be very fairly summed in one phrase, "Study your Public."

Projected Coke-Oven Gas Plant for New York.

You may remember that some time since I referred to the antics of some men seeking a new gas Charter to use in New York City. You make mention of it in your issue of March 5; and with this for a text, one could write a great thesis on American words and works. The papers the last few days have contained certain details of the Mayor's hearing; and the feeling in the street is that the whole affair is "a strike"—an attempt to make the Consolidated pay for "protection." We shall know shortly what the plan really has in view.

No one can believe that the offer made to the city by the new Company is one really made in truth and good faith; it seems quite as if they were actually promising more than they could perform, and knew it. Or (and this is my own belief) the plan to which they are working is so far-reaching that they have simply purchased a fine spaniel and cut off his tail, *à la chien d'Alcibade* in the story book. According to their prospectus and their declarations, they intend to establish works and plant at Port Morris, a point on the river to which soft coal and all kinds of material can be sent in cargoes. Here, they say, they intend to "make gas from coal, and not from oil." They also announce that the gas they will manufacture will be "genuine unenriched gas." In another speech, it is admitted that, "by manufacturing coal gas honestly and according to the best modern methods, we shall in truth be making gas for the residuals and not residuals for the gas."

This is a pregnant confession; and it is hard to believe that the man who is said to have made it would have been so very careless. But granting that he did, it shows that the offers which the "Herald" ridiculed so furiously may not be so very silly after all. It is only needful to study the plan a bit, to see that these men have the Boston scheme in their minds; but they intend to go the Boston project one better. The intention is to put up the same huge coking-ovens, make the coke the primary article in the manufacture, and, without any great amount of fuss, relieve the pressure on the Consolidated. Soft coal may not be burned in this city; it "is either anthracite or coke."

To begin with, they blackguard the Consolidated, and without hesitation hold them up to utter scorn, telling of deeds of evil and nights of woe. According to the promoters' agent, the people of New York City have been robbed of only $65,000,000 in dividends on watered stocks during an unspecified period. Never mind such a trifle as this, however, compared to the awful crime that "the Company furnish a gas which is poisonous when breathed, and whose products of combustion are fatal to human life."

This precious lot of promoters have made the following promises: First, they will make no collections on disputed bills until the State Inspector has certified the meter. (Note.—They will not, because the present laws will not let them.) Secondly, they will make no charge for putting in a meter and keeping it in order, even if it is not used. (For just the same reason given above.) Thirdly, they will furnish gas-stoves and two burners to each of their customers. (Is not this a beauty! They will go into one of the new up-town east-side tenements, furnish it with gas-stoves and two burners, and make custom. But is this philanthropy? Yes, indeed, the philanthropy which loses Heaven for a savings bank.) They have built up a huge edifice of promises; but they have no intention of coming to any performance.

The true inwardness of this precious plan is as follows: When the works of the Consolidated were built on Long Island, it was inferred that the growth of Brooklyn and New York would follow other lines than it has taken. The growth in this Long Island borough has been greater than that of "The Island Borough—*i.e.*, Manhattan—and inside of two years (if I have by any chance over-estimated, say three years) all the gas the works on Long Island (Astoria) possibly can make will be needed in Long Island, and they will be forced to build again. But it would be a very great misfortune were they forced to build in the locality in which they would have to build; so they devise this plan. For mind what I tell you, the three men who are pulling the strings in this new plan are simply the agents of the huge aggregation of brains and energy which run both the Consolidated and the U.G.I. It will take about three years to build and equip the works for this new undertaking (the papers say three months); and the increase in demand by that time will require it. Then as the units of the new plant are put in working, its output will fill the present pipes; and the public will be assured that, but for the new Company, the price of gas would not have been brought down, while the holders of stock will be told of the advantageous and satisfactory contract they have made, by which they have been obliged to lay only about six miles of pipe to the points at which they could meter into the Consolidated's mains, and then turn the product over to them for delivery. The new Company—"The Domestic" (quotha!)—do, indeed, supply the neighbourhood of the works at the prices agreed to, and they have laid (or purchased and leased *in situ*) the miles of mains required by their Charter; but they do not intend to put out any more.

You will shake your head, and say, "Are you not accusing them of useless craftiness?" Not a bit am I. Remember in this country everything is done and said by indirection. No man wears his heart upon his sleeve. No man tells the truth about any public project, because, since he must pay "backsheesh" and must bribe both the officials who represent the authorized and the newspapers who represent the unauthorized plunderer, it is never well to tell the truth about any project in which you are engaged; and while there may be some men who really do believe the Consolidated's opposition is real, they simply do not understand American (U.S.A.) ways. But granted that I am right, and that the dilemma is "a strike," as the trade papers and the "Herald" and its progeny intimate, or "a Consolidated extension" as I believe, what is the difference? Simply this, the strikers will get their Charter and sell their rights to the Consolidated clan, who will use these chartered rights when, why, and how they need them; and there will be ostentatious criticism and various mountebank suits, and the other pretences of corporate life. If I am right, there will be some sort of a bargain made by which gas from the works will be turned into the Consolidated's mains. It is worth noting that "The Domestic Company" say: "We will supply 25-candle power gas, and never anything less." In another place it is said: "The 25-candle power is for water gas; but we shall also furnish coal gas of 18-candle power. Coal gas is much brighter and stronger."

This is copied from the "Herald;" and it is claimed at the "Herald" office that this is just what the promoter said. The "Herald" official representative says: "We see nothing wrong in the statement;" and a so-called expert, reputed to be in their employ, said: "Everyone knows that 18-candle power coal gas gives more light than 25-candle power water gas." Is this ignorance, or educated wisdom, or wisdom of the Children of Light? How much more evidence is needed to show the un-truth, un-faith, and un-everything of the men engaged in the discussion of the problem in the papers?

And it is to this kind of ignorant and dishonest government and administration that you at home are being surely brought by the introduction of American political methods. But this is a century of Progressivism and Progressivists, forsooth; and I wish you may have enough of it.

M. Berthelot, the distinguished Chemist, ex-Minister for Foreign Affairs, and Permanent Secretary of the Academy of Sciences, has been elected a member of the French Academy in succession to M. Bertrand, the mathematician.

Mr. R. Martin, Chairman of the Slough Gas Company, was presented by the shareholders, at the annual meeting last Wednesday, with a tea and coffee service and a silver-mounted tantalus, in recognition of his indefatigable and faithful services to the Company for upwards of thirty years.

TECHNICAL RECORD.

WATER GAS AND OTHER COMBUSTIBLE GASES.

By Herr JOH. KÖRTING, of Hanover.

[Abstract Translation of a Communication to the Association of German Engineers.]

(*Continued from p.* 1126.)

In the following references to some water-gas plants, an attempt has been made to give, so far as practical results which have appeared will allow, some information on the utilization of the heating value of the fuel, as well as on the cost of working. For these comparative statements, it has been necessary to adopt a uniform basis for the cost of fuel; and the following prices, which prevailed in Hanover in 1899, have been used:—

Boiler coal	17s.	3d.	per ton.
Gas coal	18	3	,,
Gas coke	20	4	,,
Foundry coke, broken for gas making	20	4	,,

The two kinds of coke are of average quality; giving about 10 per cent. of clinker. Where other descriptions of coke are referred to, they have been valued according to their heating power relative to the above. Other values taken are:—

Tar	£2	0	6 per ton.
Ammonia	9	3	0 ,,
Benzol	12	14	0 ,,
German gas oil for carburetting	4	1	3 ,,
Foreign (*i.e.*, not German) gas oil for carburetting	7	2	3 ,,

The Old (European) Water-Gas Process.

This process, as described by Herr F. Fischer in his "Handbook for Furnace Engineers," is illustrated by the generator of the European Water-Gas Company, at Essen.

The generator is charged with coke through a charging opening, which can be shut gas-tight, at the top; and a blast of air is admitted from below to raise the fuel to incandescence. The gas produced in this operation is taken off through an opening near the top. Producer gas is the usual product of this blowing operation; and attempts have been made to employ it for heating boilers, or as a fuel for gas-engines. But the difficulty is to find use for so large a quantity of gas as is formed. In many installations, however, the utilization of the producer gas has been given up. It would be difficult to find use for the producer gas if the plant were set up for the supply of a town with water gas. Consequently, technical men have long aimed at diminishing the quantity of producer gas formed, or getting rid of it entirely.

When the fuel has been raised to incandescence, the outlet for the producer gas and the air-blast are shut off, and steam is admitted near the top of the generator. Water gas is thereby formed; and this is taken off through a pipe near the base, into a coke scrubber. If intended for town lighting purposes, it is further purified. Otherwise it passes direct to the place of consumption. The duration of the "blow" is 11 minutes, and that of the "make" (or "run") 4 minutes. One pound of coke, containing about 10 per cent. of ash, and having a calorific value of 3175 calories, yields about 50·1 cubic feet of producer gas, of 26·9 calories per cubic foot, and 18·1 cubic feet of water gas, of 75·2 calories per cubic foot. Of the total calorific value of the pound of coke, 43 per cent. is found in the water gas, and 42 per cent. in the producer gas. But this does not take account of the fuel used in the production of steam. The steam used comprises both that which is required for the blowing engines for providing the air-blast, and that which is decomposed directly in the making of gas. The latter amounts theoretically to 25 lbs. per 1000 cubic feet of water gas; and the consumption of steam for both purposes will here be taken at 62·5 lbs. per 1000 cubic feet, which is a very favourable allowance.

On these assumptions the following calculation of efficiency is made: Taking the evaporative power of coke to be 8, the coke required to furnish the 62·5 lbs. of steam is 7·8 lbs. The heating value of this 7·8 lbs. is 24,765 calories. Hence for the production of 18·1 cubic feet of water gas, having at 75·2 calories per cubic foot a calorific value of 1360 calories, there are required $3175 + \frac{24{,}765 \times 18{\cdot}1}{1000} = 3175 + 448 = 3623$ calories. The proportion of the fuel which is utilized is therefore 37·5 per cent. Two calculations can then be made. In the first place, if the water gas is to be regarded as the sole end of the process, there are in it 1360 calories, and for its production 3623 calories have been expended, of which $50{\cdot}1 \times 26{\cdot}9 = 1348$ calories are to be found in the producer gas, leaving 2275 calories, from which the relative utility or efficiency becomes 59 per cent. If, however, the production of both water gas and producer gas is the object of the process, there must be reckoned both the 1360 calories in the water gas and the 1348 calories in the producer gas; making a total of 2708 calories obtained from 3623 calories. Hence the relative utility or efficiency is 74 per cent. These efficiencies, however, are from the results of trials, and those for practical working would be lower.

The Humphreys and Glasgow Plant.

This is used by Dr. Hipper at the Bremen Gas-Works. The blows there are of 4 minutes duration, and the runs of 7 minutes, which are the customary times elsewhere. The results published by Dr. Hipper are as follows: The coke consumed per 1000 cubic feet of gas amounts to 31·21 lbs. in the generator and 7·49 lbs. in the boiler. The coke used is derived from English coal, and yields only 6 per cent. of ash. Its calorific value must therefore be taken at 3310 calories per pound. Taking the average calorific value of the water gas to be 70¾ calories per cubic foot, then 70,750 calories are obtained from 128,100 calories. The relative utility or efficiency amounts, therefore, to 55 per cent.

Coke of the quality referred to must be taken at £1 1s. 4d. per ton; and hence for 1000 cubic feet of gas, the cost will be 4·43d. or for 1000 calories, 0·062d. The gas is rendered illuminating by means of German paraffin oil, which, at the time, cost £4 1s. 3d. per ton. To carburet the gas to 14-candle power, 23 lbs. of oil are required per 1000 cubic feet; hence the cost of the oil used is 10d. The tar, however, amounting to 30 per cent. of the weight of the oil, brings in 1½d.; making the net cost equal to 8½d. So that 1000 cubic feet of the carburetted water gas cost, for coke and oil, 12·93d. Taking the average calorific value of the carburetted water gas at 141½ calories per cubic foot, the cost is 0·091d. per 1000 calories. Foreign oil in Germany costs over £7 2s. per ton; and hence the cost of carburetted water gas made therefrom becomes considerably greater. Using it, the cost of 1000 calories would become about 0·144d.

The Dellwik Water-Gas Process.

The Swedish Engineer, Dellwik, has avoided the loss due to the producer gas in the ordinary method of water-gas production by so operating the blow that only spent products of combustion—*i.e.*, carbonic acid from the carbon of the fuel, or, in any case, only trifling quantities of carbonic oxide—remain in the products which escape from the plant. In his patent specification, he claims that, by blowing in sufficient air, he obtains more carbonic acid than carbonic oxide in the total products of combustion of any one blow. He attains his object by applying a higher blast pressure, and by using coarser fuel and a shallower fuel bed than is usual. The process is only adapted for the employment of coke and other similar non-bituminous fuels. A greater amount of heat is stored up in the generator; so that a longer run becomes practicable. This arises from the fact that when carbon is burnt to carbonic oxide only 2442 calories are liberated; but when it is burnt to carbonic acid, 8080 calories are liberated. Practically, two circumstances might affect the intended result of the blows—viz., the generator not yielding simply carbonic acid, but also some carbonic oxide in the products of combustion, and the limit of time by which the right heat is attained in the generator being overstepped. Rules for operating the plant are, however, given, with a view to avoiding these occurrences. The duration of the blast is short—about 1¾ minutes; so that small fluctuations become more important than in the longer blast of the older processes. To what extent the result aimed at is attained has been indicated by trials of the process made by Professor Lunge and Professor Lewes.* The former observer found upwards of 19 per cent. of carbonic acid in the products of the blow, and Professor Lewes found only 1 and 1·8 per cent. of carbonic oxide in them. The duration of the run is longer with the Dellwik than with the older processes; being from 7 to 12 minutes. It is shown that the yield of water-gas is much higher than with the older processes.

Professor Lewes in his trials found a yield of 41 cubic feet of water gas per pound of coke consumed. The coke contained 87·6 per cent. of carbon. Dr. Leybold found a very slightly smaller yield. The gas had a calorific value of 70¾ calories per cubic foot. Professor Lewes ascribed an efficiency of 82 per cent. to the process, after allowing for the consumption of boiler-fuel, which, however, he only estimated. Dr. Bunte states that, disregarding the fuel consumed in the boiler, an efficiency of 72 per cent. is attainable. Taking the boiler fuel at the previously adopted figure, the 72 per cent. of Dr. Bunte would become 63 per cent. This appears a probable estimate, although it is still high for practical results, as the example given later will indicate. It is highly desirable that further exact practical data should be collected, in order that a true comparison of this important process may be made with others.

The Dellwik plant at the Königsberg Gas-Works has given the following results: The water gas manufactured contains about 6 per cent. of carbonic acid, 38 per cent. of carbonic oxide, 50 to 52 per cent. of hydrogen, and a little oxygen and nitrogen. Its calorific value is about 66½ calories per cubic foot. Coke containing 82 per cent. of carbon, 1 per cent. of hydrogen, and 1·4 per cent. of moisture, and having a calorific power of 2990 calories per pound, yields, on the average, 31·2 cubic feet of this gas per pound of coke consumed, or 32 lbs. are needed per 1000 cubic feet of gas made. For boiler fuel, inferior coke is employed, which has, allowing for the damp state in which it is frequently used, an average calorific power of 2495 calories per pound. The amount of this fuel used is 12·5 lbs. per 1000 cubic feet of gas made. Hence for 1000 cubic feet of gas there are needed:

$$32 \times 2990 + 12{\cdot}5 \times 2495 = \text{about } 126{,}800 \text{ calories.}$$

* See "JOURNAL," Vol. LXXI., p. 1127; and Vol. LXXIV., pp. 819 and 1191.

As the gas, however, has a value of about 66,500 calories, the efficiency of the process is about 52 per cent. Making allowance for the different calorific power of the coke used, the cost of the gas at the standard prices of fuel adopted would amount to about 4¼d. per 1000 cubic feet, or 1000 calories would cost 0·0636d. If the water gas is made into a 14-candle power illuminating gas by the addition of benzol, the cost of such gas will be as follows: The amount of benzol required is 8 lbs. per 1000 cubic feet; and the cost thereof may be reckoned at 10·9d. Adding this to the cost of the water gas (4¼d.), the total cost of the carburetted gas becomes 1s. 3·15d. per 1000 cubic feet. The cost of 1000 calories with this gas then becomes 0·144d.

In Königsberg, the water gas is carburetted with 1·37 lbs. of benzol per 1000 cubic feet; and the carburetted gas has a calorific power of 72¾ calories per cubic foot. The cost of the benzol would be 1·87d.; and this, added to the cost of the water gas, gives a total of about 6·1d. per 1000 cubic feet. The cost of 1000 calories then becomes 0·084d. If 20 per cent. of such carburetted water gas is added to coal gas, then 1 cubic foot of the mixed gas will have a calorific value of a little over 130 calories. It should be mentioned that higher calorific values may be found in practical working than the aforementioned calculated ones, especially when the mixing with the coal gas is carried out directly after it leaves the retorts. The water gas then exercises a solvent action on certain of the hydrocarbons which otherwise would pass into the tar. Probably also purification reduces the amount of carbonic acid present. For want of definite results from practical working, we have to fall back upon calculated values for such a general comparison as is here attempted; and these show that 7·5 per cent. more of such mixed gas should be required to afford the same return for heating and power purposes.

In order to carburet Dellwik water gas with oil, some special fuel must be used for gasifying the oil, because there is no producer gas available for the purpose, as in the case of the Humphreys and Glasgow plant. According to Herr Dicke, the oil should be run into retorts which are heated in the same way as coal-gas retorts. For firing the retorts, 10·6 lbs. of coal are required per 1000 cubic feet of water gas, of which about 3500 cubic feet can be carburetted per hour by each retort. The retort fuel would cost just under 1d. per 1000 cubic feet; and hence, taking the figures for oil used in the case of the Humphreys and Glasgow plant, the cost of 1000 cubic feet of the gas would be as follows:—

Cost of 1000 cubic feet of simple water gas	os.	4¼d.
Cost of carburetting with German oil, as before . .	0	8½
Cost of retort firing	0	1
Cost of carburetted gas . . . . . =	1	1¾

This would make the cost of 1000 calories = 0·096d. If American oil were used (in Germany), the cost of the gas would be raised to 1s. 9½d., and the cost of 1000 calories would become 0·15d. In these computations, no account has been taken of the increase of volume due to the oil.

(To be continued.)

THE NEW WORKS OF THE SOUTHWARK AND VAUXHALL WATER COMPANY.

For some few years the Southwark and Vauxhall Water Company have been carrying out considerable extensions of their works at Hampton and Sunbury; and on Tuesday last a large party, comprising Directors and officials of the other London Water Companies and gentlemen interested in water supply, were invited by the Chairman (Alderman Sir Henry Knight) and Directors to accompany them on a visit of inspection, and afterwards to witness the ceremony of turning the first sod of two new storage reservoirs at Walton. The party, which included Mr. Charles Perrin (the Official Water Examiner for the Metropolis), Professor T. E. Thorpe (the Chief of the Government Laboratory), Dr. Percy Frankland, and Sir John Aird, Bart., M.P. (whose firm are Contractors for the reservoirs), left Waterloo by special train at half-past ten, and on reaching Hampton Court were conveyed by steam launch to the Company's works at Riverdale. On landing, the first object to engage attention was the remarkably spacious and well-proportioned engine-house which has been erected in continuation of the older buildings. It contains the latest addition to the pumping plant in the shape of three triple-expansion engines of the marine inverted type, each capable of lifting 9 million gallons of water per diem under a head of 280 feet. Their cylinders are 20, 33, and 56 inches in diameter respectively, with 5-feet stroke. There are two fly-wheels, one at either end of the engine, and in ordinary working they make 25 revolutions a minute. Each engine operates three double-acting pumps, 16½ inches in diameter and 5-feet stroke. They were designed by the Company's Engineer, Mr. J. W. Restler, M.Inst.C.E., and were made by the North-Eastern Marine Engineering Company, Limited, of Sunderland. These very fine examples of mechanical skill, of which, by the courtesy of Mr. Restler, we are able to give two views, deservedly elicited many highly eulogistic remarks. Their action since they were started has been thoroughly satisfactory. The steam required for driving these giants is generated in a roomy and well-lighted boiler-house adjacent to the engine-house. It is fitted with two sets of Babcock and Wilcox tubular boilers (four and an economizer in each set), working at a pressure of 200 lbs. per square inch. The lighting of the engine-house is by means of electricity, generated by a small engine, designed by Mr. Restler, coupled to a direct-current dynamo. Arc lamps are employed.

Passing out of the boiler-house, a glance was taken at the extensive workshops, and then the company were afforded an opportunity of contrasting the modern with the antique in the matter of pumping plant. In the engine-houses forming part of the original buildings were seen a set of Cornish engines which have done nearly half-a-century's work; having been discharging their somewhat humdrum duties, as compared with those of their brilliant young neighbours in the new house, since 1854. Their working pressure of 40 lbs. is something to cause a smile; but these old servants are not brought into use now, except in cases of emergency. They are merely kept as a stand-by. The steam for the original portion of the pumping plant was furnished by a range of boilers of the old school, which look like toys in contrast with those lately fitted up. An example of more modern plant was furnished by two compound expansion engines by Moreland and Son, bearing the date of 1886, working with a boiler pressure of 100 lbs. per square inch. These representatives of what was, at the time of their erection, an advanced stage of engine construction—a stage which has now been very much passed—are still doing good duty. The Company possess altogether, at their various stations, 28 pumping-engines, of a total of 6200-horse power. From Hampton they can pump 16 million gallons of water daily to Battersea for filtration purposes, and 36 million gallons of filtered water to other parts of their district.

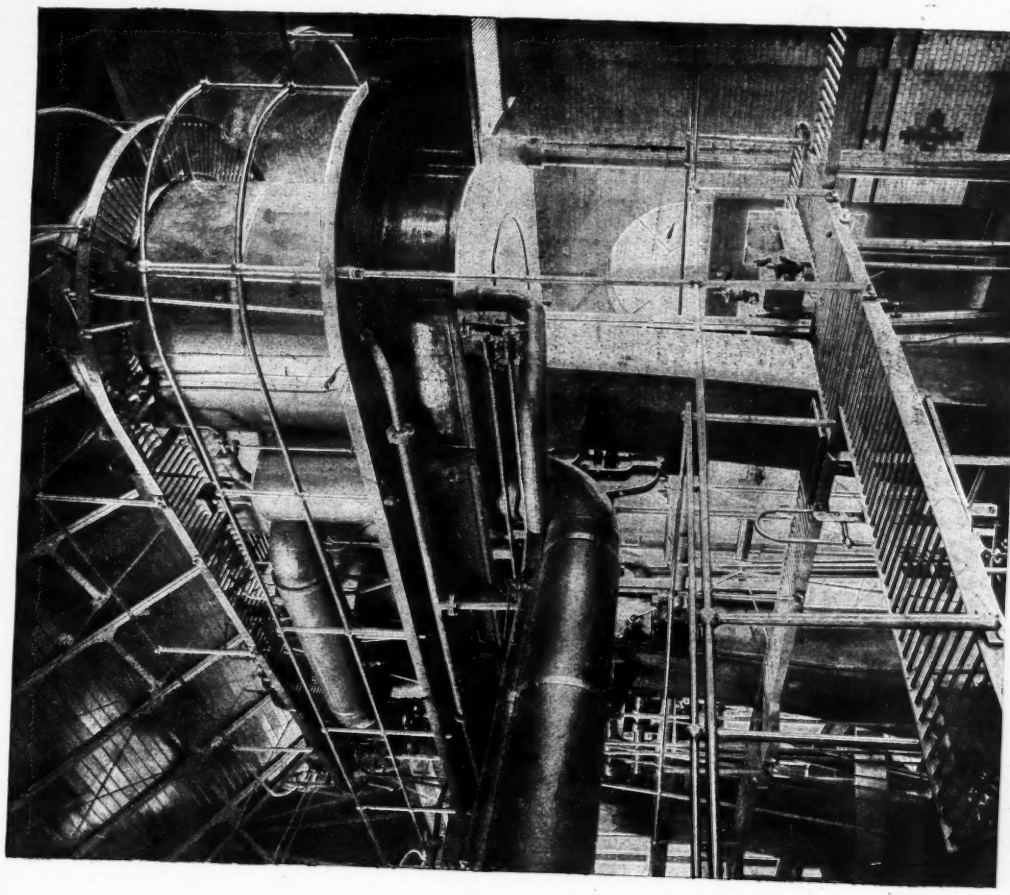
Reference to filtered water brings us to one of the events of the day—the starting of the six additional filter-beds lately completed. Before proceeding to them, however, it may be mentioned that the Company have in all 31 filter-beds, covering an area of 31¾ acres—being an average of an acre each. At Hampton there are now three sets—the first consisting of nine, the second of seven, and the third of six beds. Their location will be seen from the plan appearing on p. 1226. The first set, which are somewhat irregular in shape, occupy ground immediately adjacent to the engine-houses; the second, which are practically square or triangular, adjoin the small reservoir on the river bank; and the third—the one brought into use for the first time on Tuesday—occupy the easternmost portion of a tract of land, rather more than one-third of a mile in extent, which is surrounded on three of its sides by the works of the Grand Junction Water Company. Here there is room for eight more beds similar to those just started. These new beds, it will be noticed, are oblong in shape. Down the centre of each is a long bricked channel, into which the water is admitted. When this is full, the water flows over the edges on to the sand lying upon the bottom of the filter. The whole process is so gradual that no disturbance of the sand takes place. Facilities are, of course, afforded for taking samples of the water for purposes of examination. Farther to the west, and extending northwards, are two large storage reservoirs of the Company, having a combined capacity of 300 million gallons. Away to the north-west, and distant about a quarter of a mile, is situated the distributing reservoir in connection with the scheme now being carried out by Messrs. Hunter and Middleton for the Staines Reservoirs Joint Committee. [From this reservoir, it may be mentioned parenthetically, the Grand Junction and West Middlesex Companies, whose works, as will be seen by the plan, are interlocked, so to speak, with those of the Southwark and Vauxhall Company, will receive their share of the water furnished by the scheme.] The small reservoir on the river bank, already referred to, has a capacity of 90 million gallons. The two reservoirs at Hampton, in conjunction with those at the Battersea station, furnish storage for 436 million gallons; and the Company have covered reservoirs for filtered water equal to 19 million gallons, while others for 52 million gallons are in course of construction. Before leaving these works, attention may be directed to their contiguity, as shown by the plan, to the site of those to be carried out in connection with the scheme of intercommunication between the systems of the different Companies sanctioned by the Metropolis Water Act of 1899.

The 300 million gallon reservoir above referred to is the largest the Company possess; but two others, for which authority was obtained in 1898, have been commenced at Walton, which will have a combined capacity of 1076 million gallons. They will have a total top water area of 115 acres, and the depth of water will be 40 feet. The division wall will be 180 feet wide at the bottom, tapering to 12 feet at the top. The top level of the bank will be 70 feet, and the top water level 65 feet, above Ordnance datum. The puddle wall will be 10 feet wide on the ground line, tapering to 6 feet at the top of the bank. The site lies to the south of the reservoirs of the Chelsea and Lambeth Companies, about one-third of a mile from the river; and to it the party next proceeded. When they reached the spot selected, the ceremony of formally cutting the first sod was performed by Sir Henry Knight, on the invitation of Sir John Aird, who presented him with a handsome silver spade for the purpose. The company subsequently partook of luncheon in a marquee upon the ground. The new reservoirs, as well as the whole of the extensions which have been carried out at the works, have been designed by Mr. Restler.

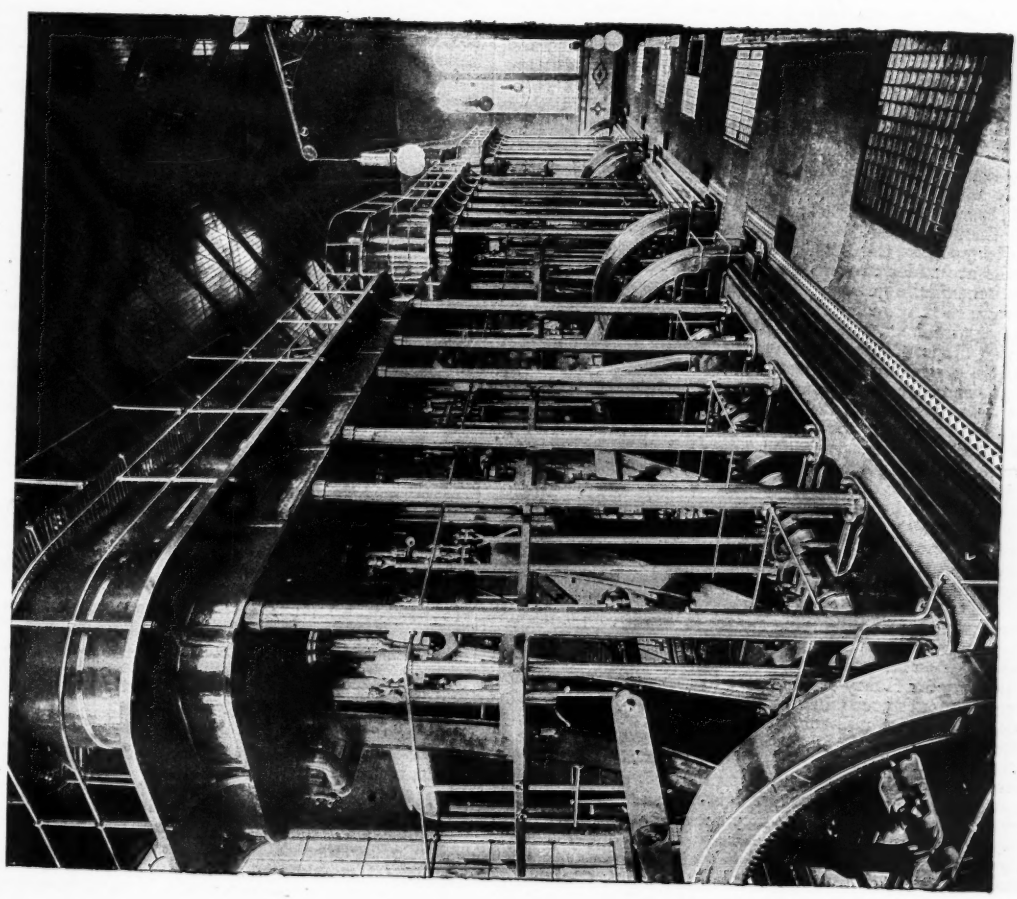
The need for these extensions was fully shown by some very striking statistics cited by Sir Henry Knight in the course of an interesting speech made by him at the luncheon. The Company over which Sir Henry so ably presides is one of the oldest in London. It is a combination of two Companies, one of which—

TRIPLE-EXPANSION ENGINES AT THE HAMPTON STATION OF THE SOUTHWARK AND VAUXHALL WATER COMPANY.

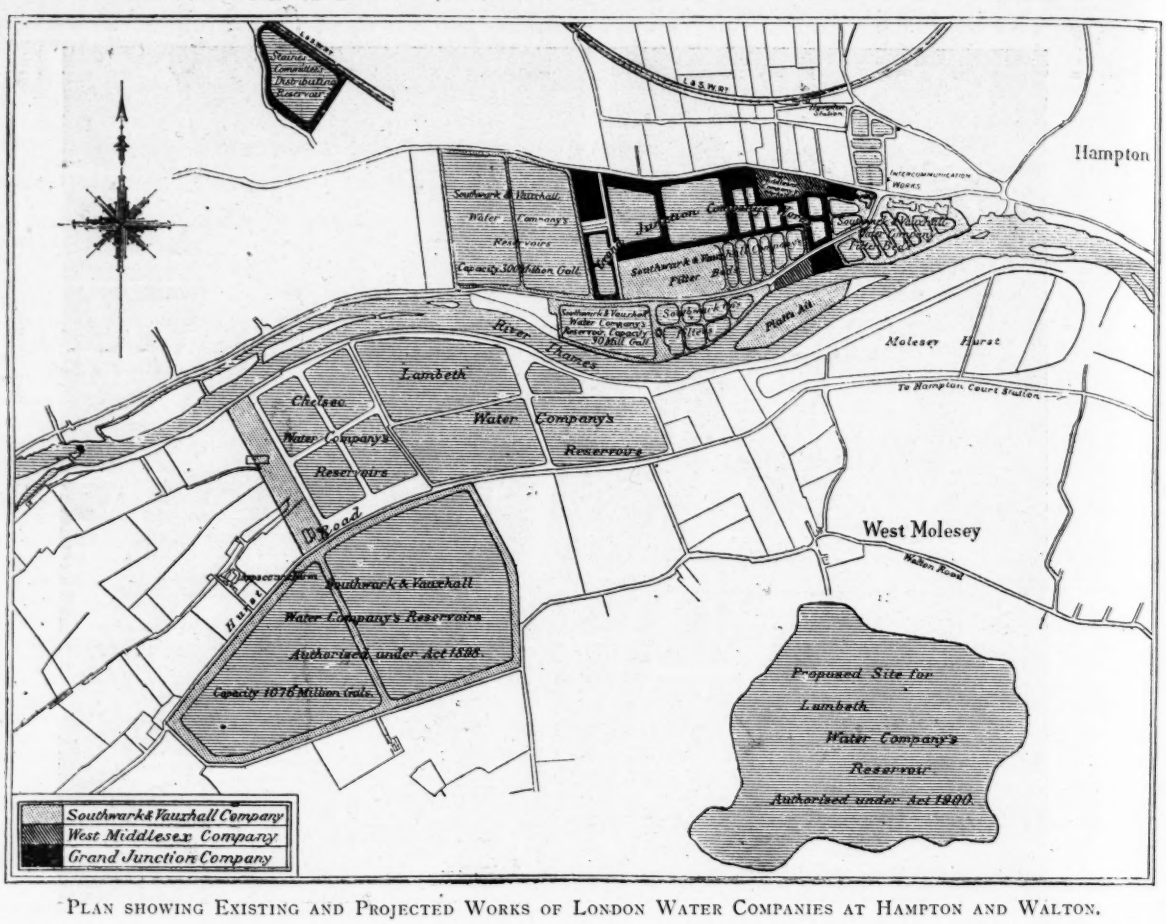
J. W. Restler, M.Inst.C.E., Engineer.



View from Middle Platform.



Perspective View.



PLAN SHOWING EXISTING AND PROJECTED WORKS OF LONDON WATER COMPANIES AT HAMPTON AND WALTON.

the Southwark—dates back to 1582. Coming down to more recent times, we find that early in the past century the undertaking which received a further development last Tuesday was furnishing to Southwark water raised by two wheels situated under London Bridge, on the Surrey side. Business grew, and in 1839 the Southwark Company made a distinct advance by constructing works at Battersea, where the intake was situated. Six years later—in 1845—they effected an amalgamation with the Vauxhall Company, formed in 1804, and became the Southwark and Vauxhall Water Company. In 1851, the Company decided to move higher up the river; and in the following year the necessary parliamentary powers were obtained to enable them to do so. The works at Hampton were the result. In 1866 they were extended; and since then other stations have been established. The present sources of supply are the Thames and a well at Streatham; while other wells are under construction at Merton Abbey and Honor Oak. The maximum quantity of water the Company are allowed to draw from the river in one day is 100 million gallons; but the average is 45 millions. The well at Streatham produces about 2½ million gallons per day. The average daily supply last year was 32,366,860 gallons; the maximum being 37,977,448 gallons. The Company's area is 50½ square miles; the number of houses supplied being 124,770, containing a population of 837,206—an average of 38·83 gallons per head daily. This quantity of water is furnished for about 22s. per house. As showing the satisfactory manner in which this large number of persons are served, it may be mentioned that the complaints average only one per day. The storage capacity, when the reservoirs just started are finished, will be 1512 million gallons, exclusive of 71 million gallons of filtered water; making altogether 1583 millions, or sufficient for 58 days' supply without drawing a drop of water from the Thames. For the distribution of the water three trunk mains—a 30-inch, a 36-inch, and a 42-inch—are employed; their carrying capacity being 52 million gallons. The pumping power is equal to 78 millions daily. To prove that those who are responsible for the water supply of London have not been unmindful of their duty in providing storage, Sir Henry cited figures to show that there is now sufficient for about 15,000 million gallons. Reckoning the greatest daily demand at 248 millions, there is storage equal to 60 days' supply, or to between 70 and 80 days' supply if the well water is added. With all this water available, and the intercommunication system for its distribution in operation, all that is required for its proper use by the consumers is adequate means for its storage in their houses; and this they should certainly see that it is to their interest to provide.

It only remains to say that on landing at Hampton each visitor was presented with a tastefully printed pamphlet, containing a coloured plan showing the Company's works and their contiguity to those of the other Companies in the district, and a series of views of the works and the new engines taken from different points. Of the latter we give the perspective and middle platform views, as being the most representative. The pamphlet likewise furnished some statistics in regard to the Company's sources of supply, the capacity of their plant, and the extent of their operations; and these were supplemented by other particulars given as the inspection proceeded by Mr. Restler and his assistants, as well as by the Company's Secretary, Mr. Montague Watts. The arrangements for the day were all admirably carried out.

OHIO GASLIGHT ASSOCIATION.

The Seventeenth Annual Meeting of this Association was held at Dayton, Ohio, on April 20 and 21, under the guidance of the President, Mr. Geo. Whysall, of Springfield, Ohio.

The reports of the Executive showed a flourishing state of affairs; and about 30 applicants were elected as members of the Association. General J. P. Harbison, President of the Hartford City Gaslight Co. (Conn.), at the invitation of the President of the meeting, delivered an address, expressing his pleasure at being present. He said that Hartford was a progressive city, and the Gas Company had endeavoured to keep pace both in respect to high quality and low price of gas. They had made all reductions voluntarily, and now supplied a 22 to 24 candle mixed gas at 4s. 2d. per 1000 cubic feet. Their ways of doing business might be considered arbitrary by some. From time to time they issued a schedule of sizes and lengths of pipes to be used on inside fittings, a copy of which was handed to every gas-fitter in the district and they required all work to pass inspection by their own officer before they would lay on gas. This rule was found to protect both the credit of the Gas Company and the interests of the consumers, and gave entire satisfaction all round. Another little matter he mentioned in connection with distribution, was that all reducing pieces and connections for main pipes were cast with the lowest portion on one plane, so as to offer no obstruction to the flow of condensed matter. The usual plan was to make the centres on one plane. A four-way piece representing two 6-inch branches, one each way, on a 10-inch pipe, made in the usual way, necessitated the 10-inch pipe being laid 2 inches lower than the 6-inch; and where several connections of this kind had to be put in on one run of pipe, the levels might be seriously interfered with. He had therefore adopted the plan of keeping all pipes on one level. This also met another difficulty sometimes experienced, and that was when a pipe was to be reduced in diameter, and it was desired that the drippage

should pass on into the smaller pipe. An ordinary 6 to 4 inch reducer brought the level of the 4-inch pipe a full inch above the 6-inch one; and therefore the larger pipe could not drain dry.

The President's address referred to the common practice of pooling or combining in all branches of trade. He suggested that small gas companies might find some advantage by combining in convenient groups according to location, both for the purchase of materials and for the disposal of residuals; thus placing themselves in as good a position as large gas companies in these respects. Gas companies were making determined efforts to secure new business; and in this connection he directed attention to the "Novelty Advertising Department," as mentioned by a prominent member.

Mr. E. E. Eysenbach, of Columbus, read a paper describing a "Gas Pumping Station." He said that, while the demand for natural gas was increasing, the pressure in the fields was continually decreasing; and this condition of affairs had compelled the natural gas companies to use compressing pumps, in order to increase the capacity of their pipe-lines and reduce the back-pressure on the wells. The history of all the companies was the same in this respect; and last year the Columbus Company decided to erect a pumping station. This had been completed and in operation since January last. The plant comprised a 1000-horse power gas-engine connected direct to the compressor, and situated in a building 80 feet long by 30 feet broad. A small annex contained a 10-horse power engine, used for starting the large one, also an electric dynamo, tanks, and regulators. The buildings were all wooden-frame structures covered with corrugated iron; and electricity was used for lighting, to avoid risk of explosion. The engine foundation was made of concrete, 56 ft. long by 16 ft. wide, and 7 ft. 6 in. deep. It was composed of 1 part cement, 4 of sand, and 6 of broken limestone, and was strengthened by the use of heavy oak planks and steel rails embedded in the lower part. The bed plates were bolted to forty-six 2-inch bolts, 5 ft. 6 in. long. The engine was horizontal; and there were four cylinders, each 25 inch by 48 inch, placed serially in line, two on each side of the main shaft. The compressing cylinders, 16 inch by 24 inch, were parallel to the main cylinders, one on each side of the shaft, and driven by a crank at right angles to the driving crank. There was one impulse in every stroke; and as the work on the compressor increased towards the end of each stroke, the impulse came at the time when it was most needed. The entire weight was 250 tons. There were two fly-wheels used, one on each side, each 13 feet in diameter, and weighing 38,000 lbs. The crank shaft, 19 ft. by 3 ft. 5 in. by 2 ft. 5 in., and weighed 14,000 lbs. The engine was started by an explosive charge of gas and air stored in a tank outside the building at 70 lbs. pressure; and the power of the engine was regulated by the quantity admitted—the composition remaining constant. A storage battery, which could be charged while running the lighting plant, supplied the electric igniters. The gas for the engine was taken from the main line, reduced by regulators to one ounce pressure, and conveyed by 3-inch pipes to the mixing chambers (of which there were two). The air inlet pipes were 12 inches in diameter, and supplied from the exterior. The inlets and outlets to the compressors were 8 inches in diameter; and the outlets were laid in a creek for a distance of 400 yards, to ensure complete cooling before re-entering the main lines. On account of the rise in temperature, good efficiency could only be obtained by compressing in two or three stages, and cooling between each. While as yet they only required one pair of compressing cylinders, provision had been made for a second pair. The pump was guaranteed to run at 120 revolutions per minute, and to deliver 12 million cubic feet per 24 hours—taking in at 100 lbs. and delivering at 315 lbs. pressure, absolute; and up to date, it had been working nearly up to this guarantee. As to consumption, he hoped to get some authentic tests shortly; but rough tests showed he was not using 15 cubic feet of gas per horse power, and he saw no reason why they should not, when working at full load, get an efficiency of one brake horse power per 10 feet of gas. But the 15 cubic feet was only 40 per cent. of the quantity that would be required to raise sufficient steam to get an equivalent amount of power. To him the gas-engine appeared the only direction in which to look for increased efficiency in the conversion of heat into power.

Mr. J. T. Lynn commenced the discussion. He said he had some experience in compressing gas, but only with steam-engines using natural gas as a fuel under the boiler. The Westinghouse people, at Detroit, were running direct-coupled gas-engines for electric lighting, and getting a duty of 11 cubic feet per horse-power with natural gas, and guaranteed 1-horse power for 15 cubic feet of artificial coal gas for anything over 50-horse power as regarded size of engine. Mr. E. F. Lloyd understood that the engine operated on the Westinghouse principle of throttling the mixture and losing compression, thus getting a lower compression on a lighter load. He would like to know if there had been any difficulty from back-firing into the storage chamber, and the regular working pressure. With an engine introduced some time ago, and carrying a chamber, wherever mixture was stored under pressure, there was trouble from firing-back. The exhaust from gas-engines could be absolutely silenced, by passing it through a cylinder half filled with water. For a 25-horse power engine, he used a cylinder 12 ft. long by 2 ft. diameter, buried underground. He admitted the exhaust at one end and let it escape at the other. With regard to the quantity of water required in the cooling cylinders, there should be 25 to 30 gallons per horse power. Mr. Andrews said that, with a 150-horse power Westinghouse engine, he effectually muffled the exhaust by running a part of the cooling water into the exhaust pipe. The water vapour effectually muffled the exhaust.

Mr. Eysenbach, in reply, said that the compression cylinders took in gas from each end, twice in each revolution. He had no trouble whatever from back-firing; and the compression before the charge was fired was 100 lbs. The engine was erected in a hurry, and was not yet in fair working order, and he wanted to get everything right before taking fair working tests. The exhaust did not make much noise, and was no objection, as there were no houses within half-a-mile. The engine was started at no load, and the gas was turned into the compression cylinders after getting up speed.

A paper, entitled "More About Concrete Tanks," was read by Mr. C. W. Andrews, of Hamilton, Ohio. Referring to a previous communication to the Association, he said that the tank built in 1897 was practically sound, and showed no sign of deterioration. Since that period, he had erected a larger tank, 25 feet deep and 53 feet in diameter, of which 10 feet extended above ground. It would be banked up about 5 feet, leaving 5 feet exposed; and this necessitated the walls being somewhat heavier than if entirely buried. They were 30 inches thick at the base, and 23 inches at the top. Complete circles of vertical boards, 14 feet long, fastened to concentric rings built up of two thicknesses of 1-inch board, sawed to the circle, were used for the forms; and the cast-iron sockets for the wall-plates were bolted to the inner circle in their exact position. Mixing boards, 12 feet square, were arranged at intervals round the outside of the circle, the inner end supported on the outer form and the outer end on the bank; and from these the concrete was shovelled direct into place. The bottom half being completed, and the wall raised 13 feet high all round, the forms were cut at intervals of 20 feet, lifted vertically by a light derrick, and placed in position for the remainder of the work, being supported on wood strips 2 in. by 4 in., properly braced and accurately centred. The mixing boards were raised on trestles, connected by a substantial barrow run, and an inclined plane was arranged for the conveyance of the gravel and cement. The height of the inner cone or dumpling was reduced with a view of minimizing the varying strains and settlements at the base; and the inlet and outlet pipes were not bedded solid in the concrete, but packed round with 6 inches of sand, with a view of avoiding strains due to the settlement of the tank.

The paper being announced open for discussion, General Harbison said that at Hartford they had had various experiences with tanks. Generally speaking, the location of the works was such that there were irregularities in the soil, and danger might be expected from cracking in the walls, whether brick or concrete. The first tank, which was built in 1849, of brick laid in Portland cement, 60 feet in diameter by 20 feet deep, was a success; but the others were not. Perhaps the ground was different, or perhaps the subsequent contractors were not so experienced as the first. One that was built by a highly-recommended firm split from top to bottom the day it was filled, leaving a space 12 feet wide between the tank and retaining wall fronting the river; and it cost nearly £400 to fill up the space and make the tank hold. After a few years, it would leak at every freshet; and there was a rise and fall to the extent of 27 feet between high and low water, which had to be considered. The tank just mentioned was subsequently lined with 4 inches of brick and cement, the old surface being chipped to secure perfect adhesion; and it proved a success. Two other brick tanks that could not otherwise be made tight, were lined with steel. About five years ago, they built a steel tank 30 feet deep and 100 feet diameter, and it proved a thorough success. It cost a little more, but he would sooner pay 30 per cent. more at first, and secure a reliable job, than have the difficult matter of a leaky tank to deal with later on. Mr. E. C. Baker recommended Portland cement as stronger not only than brick, but also stone. Many structures were supported on piles; and he supposed this plan could be adopted for gasholder tanks if the ground was bad. Of course, a good deal depended on the cost of gravel; but in any case a concrete tank was cheaper than brick or steel. The Government constructed all sorts of work in concrete, and used 6 parts crushed of stone, 3 of sand, and 1 part of cement. It was important that both sand and gravel should be thoroughly clean. The gravel should pass a 1-inch ring; and in heavy work they laid eight boulders or nigger-heads in each yard cube.

Mr. Andrews replied, and said that he considered the cost of the 1897 tank was 20 per cent. less than he would have had to pay for a steel tank at that date. He had not been troubled with cracking of the walls; but there were a few surface cracks in the rendering that were easily stopped. There were certain localities where steel was preferable; and it had been his point that concrete was cheaper and stronger than brick, and not that it was a substitute for steel. If the bottom was not good, he would prefer steel. A tank once properly built of concrete was no further expense; whereas the steel one must be periodically cleaned and painted. He had a good gravel foundation for the walls, and took care not to disturb it. The footings extended for 18 inches on each side, or 5 ft. 6 in. wide in all, and were laid and allowed to set before the wall was commenced. The thickness was 12 or 14 inches.

Mr. C. R. Faben, of Toledo, submitted "Some Observations, Pessimistic and Otherwise," which were read by Mr. Persons, in the absence of the author. He commented on the effects of optimism and pessimism in connection with ordinary business

affairs, and thought that a strong faith in the proposition that gas was a commodity generally needed, would be a great help to the gas manager and his staff. If the gas manager himself had not faith in his business, the public would soon accept his estimate; and inversely if he had abundance of faith in the merit of his commodity, the public would accept his estimate. Confidence and merit were necessary to business success; and if there was any fault in practice, it must be corrected at once. It was better to make one's own position by the exercise of foresight and alertness, than to be forced into a new position by the choice of others. Referring to his own experiences, when he remembered the methods and practices that obtained during his early years, he wondered how the Company maintained its position under such narrow contracted policy. In 1868, the minimum price for illuminating gas in Toledo was 12s. 6d. per 1000 cubic feet; and for public lighting 9s. 4½d. The charge for erecting a street lamp complete was £10 8s. 4d., and the annual rent for lighting, extinguishing, and maintaining was £1 0s. 10d. Private service pipes, usually ¾-inch, were laid free to the property line, and beyond that a charge of 1s. 6d. per foot run was made to the consumer. Meter connections were all charged for; 16s. 8d. being the price for a 3-light, and larger sizes at higher proportions. A charge of 12s. 6d. for meter rent was made on all consumptions of less than 1000 cubic feet per annum. The Company concerned themselves very little with the state of affairs on the outlet side of the meter. Trouble from frost was an annoyance to the consumer but a profit to the Company, as a uniform charge of 2s. 1d. was made for clearing the choked service; and if people preferred to wait till the warm weather came, the Company did not appreciate the fact that they lost the sale of gas. Gas was then regarded as a luxury. But now it was a necessity; and gradually things had been altered, as instanced by the practice at the present day. Gas was now sold at 3s. 11½d. per 1000 cubic feet for illuminating, and 2s. 11d. for heating purposes. Service pipes, usually 1½ inches in diameter, were laid free on the understanding that they remained the property of the Company, and house pipes, burners, stoves, and all appliances were a matter of special interest to the Company. Stoves, &c., were fixed free; and they took yearly contracts for the supply and maintenance of incandescent gas-lights. The present policy was liberal and favourable to the consumers. In times past, the services of the man who could make gas cheaply were chiefly in demand. Now gas companies wanted something more; and that was a man who could secure the maximum sales. A great deal depended upon the management as to the popularity or unpopularity of gas. He quoted from life an example of a gas undertaking under unskilled management. By negligence and apparent indifference to themselves and to the company they were created to serve, they furnished an excellent example of an unpopular company; and among surroundings of this kind, he could well understand that pessimistic views as to the future of the industry might be entertained. He would not attempt to lay down any special plan as to the lines on which a gas company should be worked, because each and every case was so differently circumstanced that it required different treatment or handling. Communities had a personality as diverse as that of different individuals. Changes in methods and practices were also necessary in sympathy with continually changing conditions. He who is silent is forgotten; he who does not advance falls back; he who stops is overwhelmed, distanced, and crushed; he who ceases to grow greater grows smaller; and he who leaves off gives up. The stationary condition is the terrible symptom that precedes death.

Mr. Butterworth, being requested to open the discussion, said there was no reason for pessimism in connection with the future of the gas industry, because gas was cheaper than electricity, and it presented a large field for fuel business. In Milwaukee, the sales of gas were about 3500 cubic feet per head per annum, which was higher than those for any other city in the States. There was a sliding-scale of charges, based upon quantity consumed, for fuel and for illumination. If only reasonable business care and energy were applied, there was every reason for confidence as to the future. General Hickenlooper said the success or otherwise of any company must depend upon the efforts of the manager. While keeping all details well up, he should be able to discern what was required, and be prepared with methods for meeting those requirements. But he did not believe in free services and appliances. Sell a good article at a fair price, and let the consumer pay for what was supplied just as he paid for other things. Free inducements were not necessary, and did not tend to establish respect for the company. The only thing he gave away was good advice. Educate the customers to believe your statements; and the best way to do that was to avoid saying anything that could not be proved. He believed in cheap gas and good service, and was taking up the sale and maintenance of incandescent lights—selling at cost price, and maintaining at 2s. 1d. per burner per annum. Mr. M'Ilhenny remarked that he had every confidence in the future of the gas business, as it was growing in all directions. Mr. Stone did not believe in too much giving away, or in educating people up to expecting things gratis. Educate people as to the advantages of gas, and they would willingly buy all the necessary appliances. He thought some companies were too anxious to get new business, and offered too high a price for it. Appliances given away must either be paid for out of current profits or go to pile up the capital charges, in either case tending to keep up the price of gas. He preferred a low selling price, careful attention to complaints, and pushing and advertising for new business. By these means alone, he had induced 70 or 80 per cent. of the residents in his district to use gas. Mr. Andrews said that many people objected to the cost of the services. In laying new services, he charged material only to capital and the labour to revenue, and thus avoided piling up the capital. The money spent in services was well invested. Mr. Malone said that at Madison he had put out 1500 stoves in the last four years, though he charged everything at a little over actual cost. He believed in strict attention to complaints, and in personal house-to-house canvassing. He did not push either fuel or illumination to the exclusion of the other, but gas for all purposes. Mr. J. R. Lynn said the wisdom of giving away appliances was a local matter. Those who had to face natural gas competition had to be more generous than where it was not known. Mr. Roper thought that if anyone was troubled as to the future of the gas industry, he might find some consolation in looking up "Brown's Directory" for the last ten years. Mr. Printz said that when selling gas at 4s. 2d. per 1000 cubic feet, he found that natural gas was taking away his customers, he was not inclined to let them go without a struggle, and so he adopted the plan of supplying and maintaining one incandescent burner for every 12s. 6d. worth of gas used per annum. He had also found that the plan of selling appliances at cost, and fixing free was a great help in retaining customers. Mr. F. B. Many said that street lighting should not be overlooked in connection with the subject before the meeting. Within the last three years, over 200,000 incandescent lights had replaced electricity in the public streets. In England, Liverpool, while having a corporation electric plant, used gaslights for the streets. Paris, Munich, Berlin, and many other cities were using incandescent gaslights for the public lamps. Superior Street, Cleveland, 1300 feet long, was about to be lit by 29 columns, carrying three burners each, and representing 360-candle power.

(*To be continued.*)

Institution of Civil Engineers.—At the annual general meeting of the Institution last Tuesday, Mr. James Mansergh in the chair, the result of the ballot for the election of officers was declared as follows: President, Mr. Charles Hawksley; Vice-Presidents, Sir William H. White, Mr. J. Clarke Hawkshaw, Mr. F. W. Webb, and Sir Guilford L. Molesworth. Among the awards made by the Council for papers read and discussed during the past session, we are pleased to notice a George Stephenson medal and a Telford premium to Mr. H. E. Jones, for his paper on "Modern Gas Practice," which, with the discussion thereon, was noticed in the last two issues of the "JOURNAL."

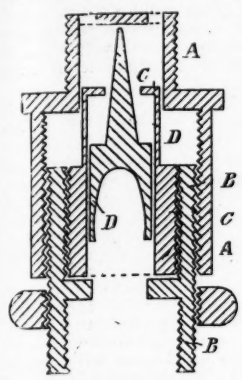
Annual Meeting of Italian Gas Managers.—The 30th yearly conference of the Italian Gas Association was commenced last Saturday, at Florence, in the offices of the local Gas Company. The President for the current year is M. A. Chamard, Manager of the Florence Gas-Works. The programme of the meeting was divided into three parts, dealing respectively with the business of the Association, technical questions, and administrative items. The first included the election of a new General Secretary in place of M. V. Krafft, whose retirement from the post, owing to his having left Naples for Paris, is much regretted by all. M. Krafft, who has also been four times President of the Italian Society, and for many years its guiding spirit, will be remembered by many English gas engineers, who visited Paris last year, for his geniality, humour, and courtesy. He contributed to the technical proceedings of the Florence meeting a note on the Letombe gas-engine. M. Rebuffel, of Bologna, discussed the question of incandescent burners for street illumination, and the most suitable means of lighting them, and also the subject of high-pressure burners to compete with electric arc lamps. Other questions considered were prepayment meters, retort-furnaces, and acetylene. In the administrative part of the programme, M. Tofani, of Asti, proposed establishing a combination between gas-works for regulating coke sales, and referred to means for interesting the staff generally in its work. Some visits and a dinner, given by the Florence Gas Company, brought the meetings to a close.

Blast-Furnace Fuels.—In the course of a paper on this subject recently read by Mr. Herbert Pilkington before the Chesterfield and Midland Counties Institution of Engineers, he remarked that recent developments in the direction of the use of blast-furnace gas for the production of power by means of gas-engines were likely to very much increase the useful duty performed by fuel in blast-furnaces. Furnaces using coal might be said to produce about 260,000 cubic feet of gas per ton of iron made; while those using coke produced about 200,000 cubic feet per ton of iron. Experience had proved that 85 cubic feet of gas from a coal-fed furnace or 125 cubic feet from a coke-fed furnace would give 1 indicated horse power in a gas-engine. About one-third of the gases produced were used in heating the blast, and in some cases with dilapidated iron-pipe stoves more than this quantity was employed. The remainder partly escaped into the atmosphere and was partly employed in steam-raising. The amount of gas used under steam-boilers to produce 1 indicated horse power was about four times as much as when used in a gas-engine. It would be no exaggeration to say that it was only a question of time before steam-boilers and engines at blast-furnaces became things of the past, and that blast-furnaces would, by the practice of economy in the use of gas for their own purposes, be in a position to supply enormous quantities of power for other purposes. By means of electrical distribution, such power could be furnished at considerable distances.

REGISTER OF PATENTS.

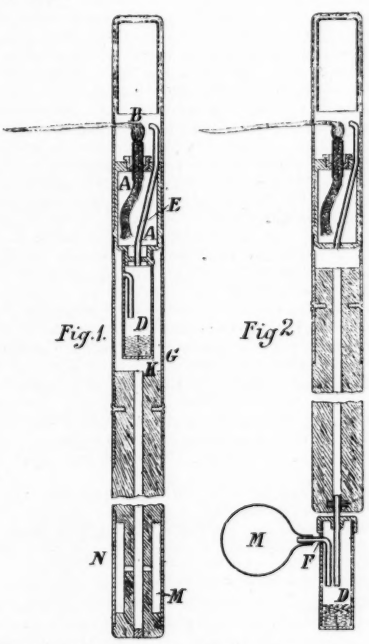
Gas-Governor for Incandescent Burners.—Billing, M. B., of Wardour Street, W. No. 5979; March 30, 1900.

This governor consists of a vertical chamber in which is fitted a conical metal pin (circular), with a number of perpendicular grooves, to admit of the gas passing upwards between the pin and the innermost casing, and which rises and falls with the pressure of the gas. The outer chamber A is screwed on the inside, so as to take the inner chamber B; and this inner chamber is also screwed on the inside, to take the innermost chamber C, in which the conical and grooved metal pin D works. For the purpose of regulating, a small milled ring is attached to the inner chamber B, so as to form a locking screw, to keep the outer chamber in position. If the governor is required to work at low pressure, the ring is lowered, and the outer chamber A screwed right down on the ring, so that the plate at the top of A will prevent the pin rising—thus allowing the gas to pass freely. For working the governor at high pressure, the outer chamber is unscrewed, so as to allow the pin to rise and almost close the aperture at the top of C—thus partially preventing the gas passing through. Metal gauze is fitted at the lower part of the chamber to prevent the pin dropping out.



Lighting and Extinguishing Gas-Flames.—Simmance, J. F., of Ravenscourt Park, W. No. 8055; May 1, 1900.

This is a modification of the apparatus described in patent No. 3683 of 1899. It is a torch for lighting gas-lamps, consisting of a combination of: An oil-lamp detachably fastened to a metallic tubular stem; a carburettor or spirit reservoir detachably fastened to the bottom of the oil-lamp, and lying inside the tubular stem; and a pole fastened to the end of the tubular stem, and having a conduit giving communication from its upper end to an annular cavity near its lower end, so as to allow of the forcing of a current of air over or through the volatile hydrocarbon in the spirit reservoir.



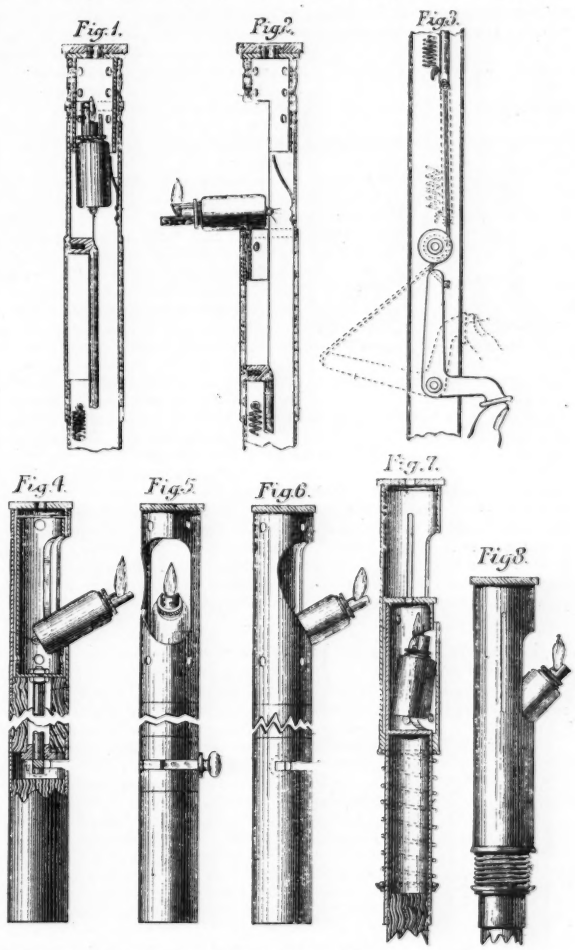
In fig. 1, the torch-flame is produced by burning colza oil, placed in the reservoir A. D is the carburettor containing the benzolene or other hydrocarbon. E is a tube leading from the top of the carburettor, with its mouth directed across the flame B, so as to send it in the direction of the gas to be ignited. A small hole in the side of the carburettor near the top communicates between the inside of the reservoir and an annular space K (referred to hereafter). A small tube leading from this hole prevents the spirit being accidentally spilled if the torch is not held upright. The carburettor is detachably fastened to the bottom of the oil reservoir by a bayonet-joint or screw. The oil reservoir is screwed on to the end of a metal tube G, which, in turn, is fastened to the end of the wooden pole. The annular space K between the carburettor D and the tube G, communicates with a cavity M turned on the outer surface of the pole near its lower end, with a piece of rubber N sprung over it, so as to serve as a flexible diaphragm. On pressing inwards the sides of this flexible chamber, a portion of the gaseous contents of the carburettor is expelled; and on releasing the sides of the flexible chamber, air is drawn into the carburettor, and becomes mixed or carburetted with the vapour of the hydrocarbon.

Fig. 2 shows a torch-pole, in which the carburettor and flexible chamber are carried separately. A short tube projecting from the carburettor D is detachably connected to the conduit in the torch-pole —a rubber washer ensuring a gas-tight joint; or the connection may be made by means of a flexible tube with connecting-pieces. The flexible chamber in this form is an india-rubber ball M fitting over the end of the tube F.

Gas-Lighting Torches.—Glover, J. G., of St. John Street, Clerkenwell. No. 10,515; June 8, 1900.

This torch for lighting incandescent and other gas-lamps is arranged so that the open flame is protected during the transit of the torch from one lamp to another; the torch-head being constructed from two or more half tubes, or two concentrically arranged tubes—one capable of sliding or turning upon the other by the action of a hand or other lever or grip, or by a pressure. The fixed half-tube carries within it the burner and oil-well or lamp proper. This is pivoted so that when the other half-tube is either pulled or pushed down, the lamp will tilt to place the flame from its burner at an angle to the stick of torch, so that it can be held over the uprising gas in the lamp to ignite it, without the torch-stick being placed at an angle. The tilting of the lamp is automatic, and a spring within the fixed half-tube gives it the first movement. On the return of the moveable half-tube, however, it forces the lamp back into its place, and protects it; air to support combustion entering through perforations in the half-tubes.

The operation of the moveable half-tubes "may be by any known means, from near the other end of the stick, or by pressure upon the torch-head. The torch may be actuated for the lamp to be tilted and exposed by action on a bell-crank lever in connection with a cord and rod; the appliances being returned to the closed position by a spring."



The illustrations sufficiently show the construction and action of the torch. Fig. 1 is a longitudinal section of the upper part of a torch and torch-head, showing the igniting lamp enclosed by the casings. Fig. 2 is a view of the lamp tilted; the moveable half-tubes being drawn down to allow of this being done. Fig. 3 is the lower part of the torch, showing the hand operating appliances. Fig. 4 is a longitudinal section of a torch-head, in which the lamp is operated by a turning movement—the lamp being shown tilted for lighting a gas-lamp. Figs. 5 and 6 are elevations of a torch (part being broken away) showing, in two positions, the lamp tilted. Fig. 7 is a sectional elevation of a torch-head, in which the operation of exhibiting the tilting lamp is effected by a pressure of the head of the torch against the inside top of the lantern. Fig. 8 shows the torch with the head pushed down and the lamp tilted.

Gas-Igniting Apparatus.—Schwarzenbach, J., of Zurich. No. 6237; April 3, 1900.

In this arrangement of electrical gas-igniting appliance, the electro-magnet employed is interpolated in the primary, and the igniting-device in the secondary circuit of an induction apparatus; and a contact-device, controlled by the armature of the electro-magnet, is inserted in the latter circuit. In this way, at the same time that the gas-inlet is opened (which is effected by closing the primary circuit, or exciting the electro-magnet), the secondary circuit is automatically closed, and the escaping

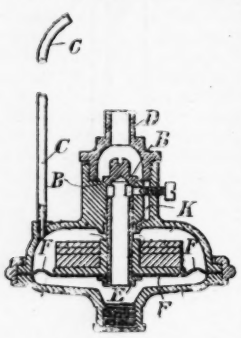
gas is ignited at the igniting apparatus; but when the primary circuit is again closed, the gas-inlet valve is closed again, and the flame extinguished. The gas-inlet valve is operated by a ratchet-wheel actuated by a pawl arranged on the armature of the electro-magnet, and having half as many catch-pins as it has teeth. These pins engage successively against a stop on the valve-rod; and when the ratchet-wheel is turned back, respectively lift it, keep it raised, and let it fall. The contact apparatus (actuated by the armature of the electro-magnet, and inserted in the secondary circuit) consists of an insulated sleeve connected with the secondary conductor, in which a conducting piston moves against a contact-screw connected with the igniting-device, for the purpose of closing the secondary conductor when the gas-valve is opened, and thus enabling sparking to be caused in the igniting-device.

Street-Lamp Lighting-Torches.—Simmance, J. F., of Ravenscourt Park, and Abady, J., of Addison Gardens, W. No. 9613; May 24, 1900.

The patentees claim: "In a lamp-lighting torch, the combination of a wind-shield with a shutter and lighting-door, one fixed, the other capable of sliding or turning, so that the lighting-door may be either completely closed, partially opened, or fully opened," in order to obviate the necessity of removing the perforated cylinder or wind shield to obtain access to the wick for adjustment or lighting.

Automatic Lighting Device for High-Pressure Incandescent Burners.—Keith, J., of Farringdon Avenue, E.C. No. 16,954; Sept. 24, 1900.

This invention has for its object to provide a device which, at ordinary or low gas pressure, supplies gas only to the pilot-lights of one or a series of burners, and on an increase of pressure supplies gas to the burners, and extinguishes the pilot-lights after the latter have lit the burners.

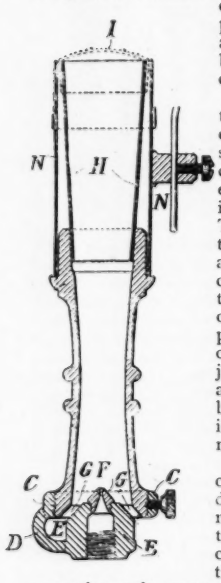


The valve B controls the supply of gas to the pilot-lights C, or to the burners fitted on the end D of the valve-casing. To the admission-end E of the valve, there is a diaphragm F, held between the upper and lower casings, and loaded by weights or springs on the side opposite to that at which the gas enters. The conical valve B has a hollow stem open at its end beyond the diaphragm; and the low-pressure gas is permitted to pass normally along this stem, and (by means of orifices in it and a bye-pass K in the casing) into the portion of the enlarged end of the casing C above the diaphragm. From this point, a number of tubes are led to their respective burners, so that these tubes (which constitute the pilot-lights) are supplied with gas when the pressure is at its normal.

When the pressure is increased by starting the compressor, the gas raises the diaphragm F, thereby lifting the valve B off its seat, and allowing gas to pass to the burners. The central stem has a ground shoulder upon it, which (on the rising of the valve B) is brought against a similar seat on the portion of the casing above the diaphragm, and prevents the passage of gas from the stem to the pilot-light tubes. At the moment of the rising of the diaphragm, the pilot-light is caused to puff out, and so the lighting of the burner is ensured.

High-Pressure Burners for Incandescent Lamps.—Keith, J., of Farringdon Avenue, E.C. No. 16,955; Sept. 24, 1900.

This invention has principally for its object "to provide greater range of adjustment of the air-admission passage in high-pressure incandescent burners," and also "to provide improved means for carrying the mantle, whereby access to the gauze top usually fitted upon such burners can be readily obtained without risk of damaging the mantle."



The burner-body is of the usual form, contracted slightly near its mid-length; the lower end being coned or flared outwards on its under side to an angle preferably of about 45° from the centre line of the burner-body. Around the lower end of the burner-body a screw-threaded ring C is made adjustable by arms D, curved beneath it. The piece E, by which the burner is secured upon the gas-supply pipe, has a gas-admission nipple F at its upper end. The nipple and its carrier are cone-shaped on their outer surfaces, so that between the body of the burner and the nipple-carrying piece E an annular space G is left parallel throughout its length. This method of construction is said to admit "of very fine adjustment of the air-admission passage," and it also "permits of the entrance of a solid annular body of air, and prevents the objectionable breaking up of the latter which is unavoidable in burners of ordinary construction."

The upper portion of the burner consists of a conical tube H, having the end which is of smaller diameter screwed into the upper end of the burner-body. On the larger and upper end of the tube is a gauze top I, having a domed end and conical wall tapered correspondingly to that of the upper tube of the burner. Around the tube, a metal mantle support or positioning tube N is placed—resting upon a shoulder thereon. This tube N is formed with a boss projecting outwards from its wall, in a slot in which the wire or rod suspending the mantle is carried, so as to permit of the removal of the mantle without touching it, and so giving free access to the gauze cover I.

Means whereby the Light in Incandescent Gas-Lamps may be Improved.—Robinson, J. W., of Harringay, and Corsham, R., of Islington, N. No. 19,794; Nov. 5, 1900.

As is well known, the mantle of an incandescent gas-burner fitted with an ordinary chimney or globe ceases to be effective as soon as the supply of gas is reduced beyond a certain limit. According to the present invention, it is proposed to control the amount of air passing through the burner and up the chimney (proportioning the same to the quantity of gas flowing through the tap), by mounting on the upper end of the chimney or globe a cap made of mica or talc, with adjustable openings, by the manipulation of which the air supply to the burner may be any quantity desired.

Coin-Controlled Meters.—Craig, J. A. I., of Paris. No. 21,394; Nov. 26, 1900.

This invention, although it relates particularly to water-meters, may be applied to any device for measuring and controlling the flow of a fluid, whether liquid or gaseous. The object sought to be attained is "to provide a coin-controlled measuring-device that will be positively locked when the water is shut off, and the hand-actuated portion of the valve-operating gear whereof (which opens the valve) will be automatically thrown and held out of operative connection with the valve from the time the water begins to flow until the predetermined quantity will have passed through the meter and the valve automatically closed." Briefly, the invention consists in combining with a meter of ordinary type a coin-controlled locking-device, the function of which is to cause the weight of a coin to unlock the valve-actuating mechanism, and enable it to be manipulated to open the valve and allow water to flow through the meter until a predetermined quantity (automatically recorded by an improved attachment) has passed through the meter, when the attachment will automatically close and lock the valve, which can then be unlocked and opened only after an additional coin has been paid into the attachment.

The illustrations (p. 1231) are a front view of a meter of ordinary type (with the casing broken away), showing the improved attachment in front elevation, and in right-hand and left-hand side elevation. The valve for controlling the flow of water into the meter is of flap-valve form A, and its oscillatory stem projects through a stuffing-box carried rigidly by the valve-casing, and constituting a bearing to support the stem. A lever B, in the form of a quadrantal gear, is hinged to a hanger-plate C mounted rigidly upon the end of the valve-stem; and an expansible helical spring bears between the quadrantal gear and a bearing plate D, secured by a pair of screws to the hanger-plate. A spindle E is mounted near the forward end of this quadrantal gear, when the latter is in its swung-back position; and it has a pinion mounted rigidly on it in a position to intermesh with the teeth of the quadrantal gear when in the position it will assume when the spring is expanded. The valve A is secured upon its stem in an angular position relatively to its seat; and to cause the inlet-port to be full open, the quadrant is swung fully back, and, obviously, the movement of the quadrant to its forward position will move the valve to close the inlet-port. This movement of the quadrant and the locking of it in its rear and forward positions, are effected by the following means.

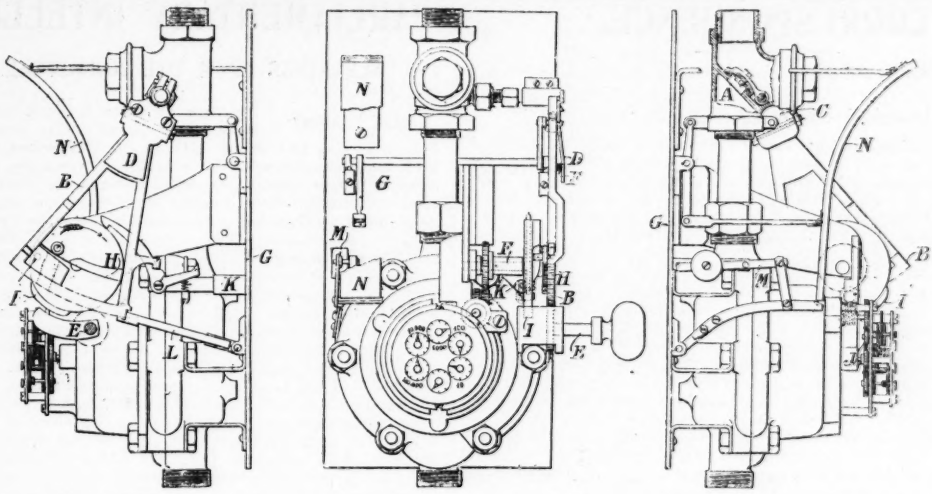
A spindle F is rotatably mounted at one end in an angular bracket secured rigidly at one end to the frame-plate G and at its other end to the meter-casing. A cam-disc is carried rigidly upon the other end of this spindle; and one-half of it is diminished in thickness, and half of the diametrical edge of the thicker portion bevelled or sheared off towards the part of lesser thickness, to provide a cam-rise H. A pin-projection, provided with an anti-friction roller, is carried by the face of the thicker half of the disc near the end of the unbevelled half of the diametrical edge thereof; and a rise I is formed on the periphery of the disc about midway of the circumferential line of the thinner half of the disc. A pinion is mounted rigidly upon the spindle F, and intermeshes with the smaller of a pair of different-sized pinions mounted rigidly upon a spindle carried rotatably in the vertical portion of the angular bracket at the end of the frame-plate. The larger of these pinions intermeshes with a worm rigidly upon a spindle, on the outer end of which a pinion intermeshes with an idler J, which, in turn, intermeshes with the pinion for actuating the train of gears of the meter's recorder.

The side of the quadrant adjacent to the cam-disc carries a plate the groove whereof receives the pin as the disc rotates, while a pin-projection upon the plate bears yieldingly, through the action of the spring, upon the face of the cam-disc, to receive movement therefrom against the spring.

The means for locking the quadrant in its full-back position is actuated by the peripheral cam-rise I, and consists of a bell-crank lever, fulcrumed to a bracket-arm secured rigidly to the back-plate of the meter, and one arm of which is formed with a rigid locking-pawl adapted to (at times) engage a notch in a rigid projection upon the rear side of the quadrant. An expansile helical spring bears between this lever-arm and a projection from the bracket-arm K, and constantly maintains the bell-crank lever yieldingly in a position to have its locking-pawl engage the notch in a projection upon the quadrant; while, at the same time, the other arm will be yieldingly held in a position to be engaged by the peripheral rise I, and oscillated to, at the proper time, disengage the locking-pawl from, and release, the quadrant.

The quadrant is locked in its forward position, and unlocked when the coin is deposited, by means of a lever-arm L secured rigidly at its rear end upon a spindle mounted in a bearing upon the back-plate of the meter; the lever-arm being of sufficient length to have its forward end (which is of bayonet form) receive the rear end of the quadrant when it is in its forward position, thereby locking the quadrant in this position. A lever-arm is secured rigidly at its rear end to the opposite end of the spindle, and has its forward end off-set and flattened, so as to support the coin as will be presently shown. A weighted lever M is connected to the coin-supporting lever, to normally hold it yieldingly in its elevated position, and the locking lever-arm yieldingly in a position to engage the quadrant.

The coin-throat N is hinged at its upper end to the end of a bracket-arm secured to the back-plate of the meter. A spindle mounted in

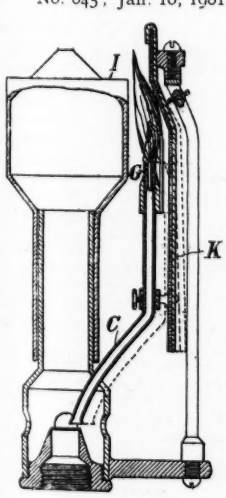


bearings on the back-plate, and a pair of lever-arms upon its opposite ends, constitute a bell-crank lever, one arm of which is pivotally connected to the throat, and the other arm to the quadrant. This arrangement enables the quadrant to automatically adjust the throat so as to either have its lower end immediately over, and obstructed by, the coin-support, and so cause a coin dropped in the throat to rest upon it, or to have its lower end clear of the coin-support, so as to allow the coin to fall from the throat.

The pinion on the spindle F is relatively o the other gears of the train of a diameter to allow one tooth for each 12½ Imperial gallons of water supplied; and obviously, if it is desired that a greater or less quantity of water be supplied for the value of the coin necessary to operate the locking-device, this gear will have to be replaced by gear with some other number of teeth. Consequently, the gear acts as a means to reckon the number of gallons passing through the meter.

The operation of starting and of automatically shutting off the flow of water through a meter is as follows: A coin dropped into the throat N will, with the parts in the positions shown in full lines, rest upon the coin-support, and simultaneously depress it and the locking-lever L, thus freeing the quadrant. Upon the handle on the spindle E being then turned, the quadrant will be swung to its full-back position, thus raising the flap valve A and allowing the water to flow through the meter. Simultaneously the throat will be moved to a position with its open lower end clear of the coin-support, and the locking-pawl will engage the notched projection upon the quadrant, and lock the latter in its full-back position. Immediately the water begins to flow, the cam-disc in its rotation (through the train of gears, including the reckoning gear, that operatively connect the recording-dial mechanism to the cam-disc) will swing the quadrant on its hinge, out of mesh with its operating pinion. The water will continue to flow in full volume until the peripheral rise upon the cam-disc moves the locking-pawl out of locking engagement with the notched projection upon the quadrant, and the pin-projection on the face of the disc engages the quadrant and commences to swing it forward—thus beginning to close the valve. The cam-disc, continuing to rotate, will swing the quadrant to its extreme forward position; and as the pin-projection issues from the groove and releases the quadrant, the abrupt fall in the face of the cam-disc will allow the spring to throw the quadrant into engagement with the pinion, and simultaneously the locking-lever will engage the rear end of the quadrant and lock it in its extreme forward position, to be released only by dropping in another coin.

Self-Igniting Attachment for Gas-Burners.—Beese, R., of Dresden. No. 645; Jan. 10, 1901.



The invention consists of a tube C having its lower end obliquely passing through a slot in the wall of a bunsen burner, and which lower end, when no flame is burning, projects partially over gas-channels formed in the supporting pillar. The tube is mounted on an actuating compound metallic plate K formed of two plates. The upper end of the tube carries the igniting-body G with its self-igniting platinum threads above, over which the gas from the tube C passes, and causes to ignite a small flame adjacent to the main burner I, in which the principal flame is ignited. The heat then radiated causes the plate K to bend and assume approximately the position shown in dotted lines, carrying with it the tube C, so that its lower end is withdrawn (as also indicated by dotted lines) from over the gas-channels; and the flow of gas is thereby automatically cut off after the gas at the main burner has been ignited. When the main light is turned off, the plate K, rapidly cooling, restores the tube C to its original position in readiness for its next operation.

APPLICATIONS FOR LETTERS PATENT.

7286.—Sharpe, J., and Code, R. G., "Acetylene gas apparatus." April 9.

7288.—Wheeler, C. H., "Cooling towers for reducing the temperature of fluids." April 9.

7304.—Mitchell, H. J., "Raising, breaking, sorting, conveying, and loading coke, and analogous substances, in connection with gas-works." April 9.

7327.—Lucas-Girardville, P. N., "Valve device for gas-pipes and nozzles." April 9.

7361.—Priestley, G. F., "Incandescent burners and gas lighting." April 10.

7380.—Bobrick, G. A., "Utilizing liquefied gases as a motive power." April 10.

7469.—Vogt, A., "Internal combustion motors." April 11.

7481.—Hutchings, J., "Gas and similar engines." April 11.

7482.—Palmer, G. L., and Patenaude, S. E., "Safety gas-burners." April 11.

7529.—The Omega Odourless Gas-Stove Syndicate, Limited, and Strong, H. O., "Stoves." April 12.

7645.—Melhuish, A. G., "Two-cycle gas or oil engines." April 13.

7646.—Rohde, R., "Gas cooking-stoves." April 13.

7655.—Liversedge, A. J., "Lanterns for street-lamps." April 15.

7656.—Matthews, J., and Davies, W., "Gas or oil engines." April 15.

7709.—Dodgson, F. L., "Pressure-reducing valves." April 15.

7711.—De Mare, F., "Gas-stove." April 15.

7720.—Walters, F., "Acetylene-lamp." April 15.

7723.—Abraham, F., "Burners." April 15.

7821.—Thompson, W. P., "Obtaining light, heat, or motive power from gaseous fuel." April 16.

7845.—Foulis, W., "Charging retorts." April 16.

7865.—Crossley, G. & F., "Incandescent burner." April 17.

7886.—Goulden, T., and Reeson, J. N., "Securing the lids of gas-retorts." April 17.

7920.—Gore, H. J., "Coin-freed gas-meters." April 17.

7947.—Hunter, J. A., "Lamps." April 18.

7995.—Terraneau, E., "Atmospheric gas-burners." April 18.

7997.—Dickson, W. K. L., "Incandescent gas lighting." April 18.

7998.—Dickson, W. K. L., "Incandescent mantles." April 18.

8030.—Temblett, S., "Adjustable double collar for repairing gas or water mains *in situ*." April 19.

8053.—Barr, J., "Liquid meters." April 19.

8059.—Whitelow, E. T., and Ehmann, C. P., "Incandescent gas-lamps." April 19.

8107.—Melhuish, A. G., "Gas or oil engines." April 19.

8129.—Schill, C. H., and Primrose, W. G., "Manufacture of gas." April 20.

8195.—Winter, R., "Stoves." April 20.

8235.—Rowbotham, W. & K. A., "Gas-engines." April 22.

8239.—Howse, H. B., "Gas and oil engines." April 22.

8268.—Tönnies, H. A. F. B. H., "Acetylene generators." April 22.

8275.—Boult, A. J., "Incandescent or bunsen gas-burners." A communication from the Société Lumière Boule. April 22.

8281.—Boult, A. J., "Mantle supports for incandescent gas-burners." A communication from the Société Lumière Boule. April 22.

8302.—Hawley, J., J. W., & W., "Machinery for putting together, or building up, wood grids for gas-purifiers." April 23.

8372.—Haddan, H. J., "Acetylene generators." A communication from the Adams and Westlake Company. April 23.

8379.—Chapman, E. F., "Engines worked by gas or vapour." April 23.

8387.—Glover, R. T. & J. G., "Atmospheric gas-burners." April 23.

8449.—Mond, L., "Gas-producers." April 24.

8454.—Dittmar, G., "Adapting ordinary gas-meters to measure high-pressure gases." April 24.

8458.—Potter, W. G., "Rotary pumps, motors, and meters." April 24.

8474.—Cleland, J., and Stewart, J. C., "Pressure-reducing valve." April 25.

8479.—Roy, F. M. St. O., "Producing incandescent light." April 25.

8480.—Kemp, C. W., "Attaching shades to gas-lamps." April 25

8502.—Holt, J., "Incandescent mantle holder." April 25.

8525.—Scharrer, C. F., "Gas singeing machines for fabrics." April 25.

8557.—Cowan, W. H., "Prepayment gas-meters." April 25.

8571.—Lockwood, W., "Valves for fluids or gases." April 26.

8630.—Spooner, A. F., "Gas-producers." A communication from Lucien Inchauspé. April 26.

8673.—Johnson, C. M., "Means for generating power from the waste heat of explosion engines." April 27.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by correspondents.*]

Arsenical Poisoning from Beer.

SIR,—The question has been raised that there is some possibility of the presence of arsenic in beer being derived from the fuel used for malting purposes, with special reference to the employment of gas coke. This allegation, if true, would be very serious, and is certainly worth the most careful consideration. I have thought it would be possibly interesting to place on record the result of my own limited investigations on the subject.

At the Commercial Gas-Works, we use a large proportion of coals known respectively as "Boldon" and "Waldridge." I have made a test on a mean sample of the coke from both of these coals, and have failed to detect even the smallest trace of arsenic. On the general question, I think that it can be safely assumed that the organic matter constituting coal is free from arsenic, and that any arsenic found is due to the presence of pyrites, which is usually rejected before carbonization, for obvious reasons. Presuming that arsenical pyrites was present in the coal, a portion of the small amount of arsenic would, no doubt, pass into the gas, leaving a minor proportion in the coke. If during the use of the coke for malting purposes the whole of the residual arsenic was burnt off, we still have to assume that this deleterious material is condensed and deposited in the malt.

In my opinion—and I speak with all due deference to those who may hold different views—this question of the possibility of arsenical poisoning in beer being due to the use of coke for malting purposes is ridiculous. The question has simply been raised as a subterfuge, by the interests representing the sulphuric acid and glucose manufacturers, to evade responsibility. Any ordinary man, possessing an average amount of common sense, and an average amount of scientific knowledge, could have foreseen from what sources the mischief would arise. If arsenical poisoning in beer had been due to the fuel used for malting, the mischief would have been manifest years ago, and would have preceded the advent of cheap sulphuric acid and artificial brewing adjuncts.

Stepney, May 1, 1901. H. LEICESTER GREVILLE, F.I.C., &c., Chemist to the Commercial Gas Company.

SIR,—I notice in your issue of the 30th ult. some remarks on Messrs. Archbutt and Jackson's paper on the estimation of arsenic in coke, in which you express the hope that both the acid and the vessel used were of unexceptional character. I think that Mr. Archbutt's name is sufficient guarantee that every care was exercised to make the result a true estimation of the amount present in the samples submitted, and that his great experience in various analyses (as Chemist to one of our largest Railway Companies) places him in an unusually good position for dealing with this matter.

With regard to the question of the sampling of coke, the portions analyzed were taken from the bulk by myself; and, although I cannot, of course, guarantee that the particular waggon selected was representative of the whole output from the colliery, the sample was undoubtedly representative of that waggon. The method employed was as follows: Coal representing the whole of the waggon was charged into a 20-feet through retort. Half of this, after carbonization, was drawn into a coke-barrow, and quenched sufficiently to allow of its being emptied on a hard asphalte floor. It was then quartered in the usual way; and as the quantity became smaller, the larger lumps were broken up. Care was in all cases taken to ensure there being a proper proportion of small and large.

Derby, May 2, 1901. HY. FOWLER.

Removal of Gas-Lamps by Urban District Councils.

SIR,—Will some readers of the "JOURNAL" kindly give me their opinion as to whether the Urban Council of the town can order my Company to remove all the columns and brackets that have done duty for many years as public lamps, without compensating the Company for the cost of removal? I may add that we are a limited liability Company, without incorporation. The Council are putting down an electric light station, and propose lighting the whole district with electricity; hence their order to remove all the existing public gas-lamps.

I think I have seen a case reported where a gas company were paid for the removal of the lamps.

Sleaford, May 3, 1901. H. WIMHURST.

Buckley District Council and the Gas-Works.—At the last monthly meeting of the Buckley District Council, a discussion took place relative to the proposal to purchase the local gas-works. The Lighting Committee had had the subject under consideration, and they recommended the Council to rescind the resolution authorizing the project. Mr. Lamb moved an amendment that the resolution be not rescinded, but that before purchase was proceeded with the Gas Company be asked to state terms for the supply of gas through the existing mains, and also for future extensions. On being put to the vote, the amendment was carried by a large majority.

Gas Explosion in Leeds.—An accident of an unusual character occurred in Park Place, Leeds, last Wednesday afternoon. A large chamber provided for the purpose of enabling workmen to reach the underground electric wires and gas-pipes became filled with gas, and a light coming into contact with it, an explosion ensued. The whole of the pavement round the chamber was blown up, while an errand boy who was passing at the moment of the explosion was injured, and had to be conveyed to the Leeds Infirmary. Men were engaged in a distant chamber, and it is assumed that the naked light which was being used there might have caused the explosion; the chambers being connected by the conduits for the electric wires.

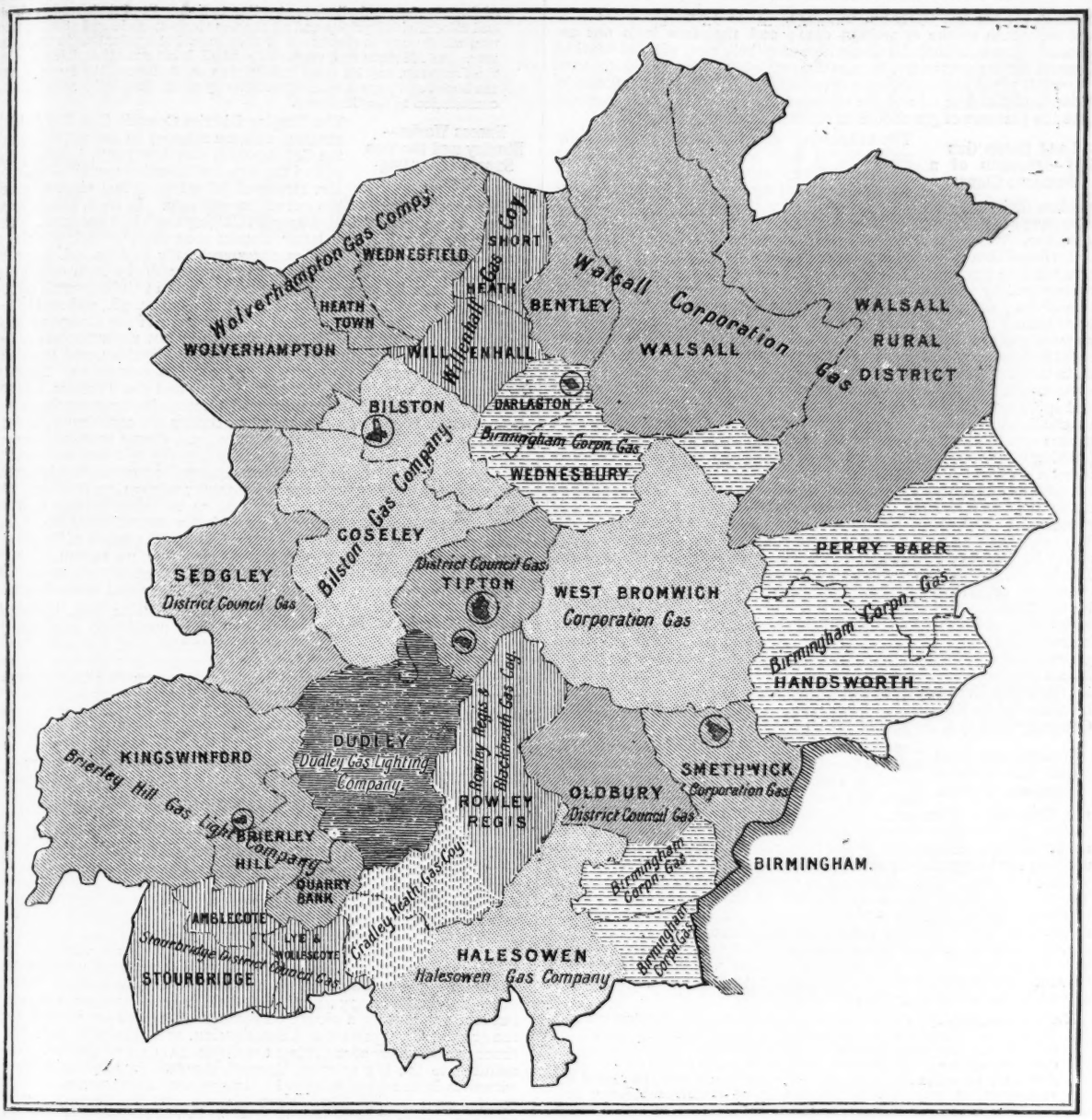
PARLIAMENTARY INTELLIGENCE.

GLEANINGS FROM THE COMMITTEE ROOMS.

Marked Progress. Pressure of other matters has caused a little lapse in the record under this heading of the doings on Gas and Water Bills in the Committee Rooms; but this week we have succeeded in bringing our notes up to date. Several Bills, it will be seen, have passed through the Committee stage, and most of them have been brought into a condition which satisfies opponents, and so will not call for a second investigation before a Committee of the Upper or Lower House—as the case may be. This is satisfactory; and it is still more gratifying to be able to state that agreements between promoters and opponents, without going into Committee, is still a feature of the session. The opposition of the Shrewsbury Corporation to the Gas Company's Bill has been withdrawn—an amending clause as to the price to be charged for gas having been inserted. Agreements have also been effected in the cases of the Chester, Harpenden, Newport (I.W.), and Weston-super-Mare Gas Bills. The terms of the settlement in the last case are referred to elsewhere. The Smethwick Corporation Bill will also now proceed without opposition; and the outstanding points on which there was opposition to the South Essex Water Bill have been arranged after a brief discussion before Lord Ribblesdale's Committee. Colonel Welby's Committee are at length on the last Bill—the Mond—referred to them; and at its close the members will have earned a little repose. All the Bills, but one, which fell to their lot have been measures over which a great deal of contention has arisen. There was the great struggle over the Derwent Valley Water Board's proposals, then the Ilkeston and Heanor Water Board question, afterwards the Kettering Water Bill, and now the Mond Gas Bill—each of which have required several days for discussion. The Committee were one of the first to commence sitting this session; and by the time the Mond scheme has been disposed of, the members will, we fancy, hold the record of the session, not only for the length of time they have sat, but for the patience and forbearance they have exhibited. The South Metropolitan Gas Bill has been referred to a Committee who will commence their sittings on Thursday.

Purchase Ebbs and Flows. At the beginning of this session we joyfully rubbed our hands at the discomfiture of would-be municipalizers of gas-works; but this week we experience a slight—and only a slight—depression as we glance over the proceedings of the past fortnight. There is not an example of compulsory powers of purchase being granted in the case of a gas undertaking; but there is one of a Water Company being brought to an end against their will. Two or three authorities, however, have arranged purchase clauses in Gas Company's Bills, which will enable them to gain their ends without much worry hereafter. In the case of the Long Eaton Gas Bill, a purchase clause has been agreed upon; and the same thing has happened in the case of the Weston-super-Mare Gas Company—in the former after the Committee stage had been reached, and in the latter before. The Devonport Corporation and Gas Company also came to an understanding as to purchase while the Bill of the former was in Committee. Devonport gas affairs have occupied so much of our space of late, and this particular question of purchase was dealt with in our editorial columns last week, that it is unnecessary to comment upon it here. The Bingley District Council are going to purchase the Cullingworth Gas Company; but the parties were previously agreed on the question of transfer—the only point between them being that of terms. As reported last week, a Commons Committee agreed to the measure of the Wells Corporation for the compulsory purchase of the Water Company's property, on the ground that it was the practice of Committees to hold that local authorities were the best persons to be entrusted with the water supply of their districts. But only this session the Committee on the Hartlepool Bill did not think so, nor did the Committee on the Burgess Hill Water Bill in the past week. The Llandrindod District Council have carried their Bill for purchase through the Committee stage in the Commons; but here again the Bill only confirms powers previously obtained. Altogether the cases mentioned do not furnish much material for upholding the advocates of the principle of municipalizing trading enterprises.

Mond Gas. Committee Room No. 13 will soon have something of an historical interest for the gas profession. In it the memorable fight over the perambulating photometer Bill of the London County Council took place last session, the conflicts over the Gaslight and Coke and South Metropolitan Bills of the same session were waged within its walls, and now the struggle is proceeding there over the Mond Gas Bill. In this measure, the gas industry in the manufacturing parts of the country is very deeply concerned; for if the promoters succeed in carrying it through, either in its present or a modified form, and any measure of prosperity attends the scheme, the investment of other districts by Dr. Mond and his colleagues will only be a question of time. The area over which the promoters in their modesty now propose to take power extends from the extreme northerly point in the Walsall district to the southern extremity of the Halesowen district; and on the east Perry Barr (in the district of the Birmingham Corporation gas area) is the boundary, and on the west the outside borders of the Wolverhampton and the Brierley Hill gas districts define the limits. A better idea of the size of the district will be afforded when we say that gas is supplied in it by no less than eight Local Authorities and a similar number of Companies. The map which we reproduce represents a gigantic map which is suspended in the Committee room for the information of all concerned; but the large map was thickly dotted—the dots indicating the position of factories to which the supply of Mond gas, in the opinion of the promoters, would be a supreme boon and blessing. There is just a score of Counsel engaged on the Bill—four for the promoters, and the remainder for the opposition, which is composed of four Gas Companies and nine Local Authorities. Both sides have retained numerous witnesses; and these, with the retinue of clerks and officials, and quite a crowd of persons more or less directly interested, cause at times an uncomfortable oppression in the public part of the room. Look where one may, the eyes alight on gas engineers from the Midlands, whose



THE MOND GAS BILL—Map of Proposed Operations, showing the Districts of the Local Authorities and Gas Undertakings Affected.

The Encircled Dark Spots indicate the Lands Scheduled for Works.

faces, or rather most of them, are more familiar at meetings of the Midland Association than in the Committee Rooms at Westminster. However, there they are; and they have, with praiseworthy fortitude and manifest devoutness, watched the proceedings day by day on behalf of their undertakings. The Bill was reached last Friday week, but even before then witnesses from the Midlands had to waste a day or two in attendance, owing to the length of time spent over the Kettering Water Bill. The end of the promoters' case was reached on Thursday; and the opposition case was commenced by Birmingham. On Friday the Committee adjourned until to-day; and it is expected that Wednesday afternoon or Thursday will see the Bill out of the Committee's hands. We publish elsewhere a long account of the proceedings to the close of the promoters' case; the witnesses in whose evidence readers will be most interested are Mr. Herbert Humphrey (whose paper before the Institution of Mechanical Engineers recently attracted so much attention), Professor Dewar, and Mr. H. E. Jones, the Engineer of the Commercial Gas Company. Mr. Jones's appearance in support of the Bill caused quite a little flutter of excitement in the opposition camp. Mr. Charles Hunt, Mr. E. Orford Smith (the Town Clerk of Birmingham), Mr. Dugald Clerk, and Mr. Corbet Woodall were the witnesses called on behalf of Birmingham. Mr. Henry Hack was also in attendance. Further reference will be made to the proceedings next week, but in the meantime it may be said that more than one engineer on the opposition side thinks that a better front would have been presented to the Committee if the several opposing bodies had combined forces. Others, however, are of opinion that each district possesses characteristics which require individual treatment by both Counsel and witnesses.

The Aldershot Gas Company's Triumph.

The Aldershot District Council appeared in Committee-room No. 5 on Tuesday and Wednesday in opposition to the Gas and Water Company's Bill; and no doubt by this time they wish they had not. The Committee told them as plainly as they could that they had no case; and the feebleness of their opposition is to-day the uppermost subject of conversation in the Aldershot district. And the belligerent councillors of this military centre may rest assured that they will hear further of it when the ratepayers learn the expense incurred in this fruitless expedition against the Company. One of the main proposals of the Bill is the acquisition of the undertaking of the Yorktown Gas Company, according to the terms of a scheduled agreement—the consideration being £16,000. The capital is to be increased by £120,000, and one-fourth loan, bearing 7 per cent. ordinary, and 5 per cent. preference interest. Several other powers are asked for—such as the extension of the district of supply, the acquisition of lands, &c. The initial cause of the Company's application to Parliament this session was the Yorktown purchase; and the frivolous allegation was made by the Council that the purchase would interfere with the proper supply of the existing district. Mr. A. F. Wilson, the Chairman of the Company, underwent a long examination at the hands of Counsel both for and against him; but he came out of the ordeal well. Mr. Corbet Woodall (whose firm has been advising in the affairs which led to the promotion of the Bill) was also in the chair a considerable time on Tuesday, and again on Wednesday morning. His opinion on the purchase of the Yorktown gas-works is that it is a good bargain for that Company's shareholders, and an altogether wise transaction on the part of the Aldershot Company. On the water proposals of the Bill, Mr. E. B. Taylor was the professional witness. Throughout the proceedings, Mr. R. W. Edwards, the Secretary of the Company, was kept actively engaged. The opposition was backed by Mr. E. H. Stevenson, who considers, if the Yorktown works are dismantled as is proposed, the purchase will be a most improvident one; but Mr. Woodall is of a contrary opinion. The only really solid complaint Mr. Stevenson advanced against the Aldershot Company is that he found they supply gas at an excessive pressure. He is also strongly of opinion that separate accounts should be kept as

between the gas and water undertakings. That is practically the sum and substance of the opposition case; and therefore it is not an astonishing matter that the Committee saw their way, without hearing Counsel for the promoters, to pass the preamble of the Bill with only two small stipulations—that the maximum of differential price outside Aldershot should be 1s. and the minimum 6d., and that within a certain time the pressure of gas should be reduced to a normal degree.

Long Eaton Gas Bill—Insertion of a Purchase Clause.

The exhaustion of the money powers and the prosperity of their business brought the Long Eaton Gas Company to Parliament this session for an increase of capital and for power to consolidate their stock on a 5 per cent. basis. The additional capital the Company asked for was £66,000, with £33,400 by borrowing—a total of £100,000. When the Bill was reached by Colonel Welby's Committee, it was found that there was only one opponent—the Long Eaton District Council who (contrary to the usual experience) were satisfied by being represented by only one member of the Parliamentary Bar. A reduction of the proposed new capital and the insertion of a purchase clause were among the requirements of the Council. A couple of hours or so were spent in discussing the measure; and then came the adjournment for luncheon, which, as has been pointed out in these notes before, is, in the Committee room lobbies, a period of the day in which, in some mysterious way, the rough places which exist between promoters and opponents frequently become smooth, and agreements result. The luncheon adjournment brought a settlement in this case. The promoters agreed to shed £40,000 of the amount of capital they asked for (making it £45,000 for share purposes, and £15,000 borrowed), and to insert a one-year purchase clause. The Company, if the Council apply for powers of purchase next year, are not to oppose, excepting in so far as they are interested in obtaining clauses to carry out the present agreement. The terms are very similar to those introduced in the Whitwick and Coalville Act of two years ago. The Company's works are to be purchased as a going concern under the provisions of the Lands Clauses Act; 10 per cent. is to be allowed for compulsory purchase; the costs of the present Act and for winding up are to be borne by the Council; and officers of the Company who do not take service with the Council are to be fairly compensated. The standard price is to be reduced from 5s. 2d. in Long Eaton and 6s. 2d. outside to 4s. and 5s. respectively. Negotiations had been pending between the parties before they appeared at Westminster; and this presumably accounts for the ease with which a settlement was effected when the measure had been carried to this stage. The terms, it may be said, are fair to a Company willing to dispose of their property.

Weston-super-Mare Gas Bill—Another Purchase Clause.

The Weston-super-Mare Gas Company's Bill came before Lord Morley as an unopposed measure last Thursday. The Agent was Mr. J. C. Ball; and among others present were noticed the Company's Manager, Mr. J. H. Gray and Mr. W. A. M'Intosh Valon, the Company's expert adviser. The Company agreed to the raising of their illuminating power from 10 to 15 candles; the Act prescribing the low quality of 10 candles having been obtained nearly fifty years ago (1855). The maximum price was reduced from 6s. to 4s. The old 10, 7½, and 7 per cent. capital—in all £39,400—is converted by the Bill into £59,560 of 5 per cent. capital. The new capital granted to the Company, including premiums, is £36,000; and they are to be entitled to raise one-fourth loan on all issued capital. The testing-place is to be at the Town Hall; and the Company, in their officers and servants, are to have free access to it at all times. The Company also agreed to the insertion of the following purchase clause:—

> If at any time, within five years from the passing of this Act, the Weston-super-Mare Urban District Council (in this section called the Council) shall apply to Parliament for power to purchase the undertaking of the Company, the Company shall not oppose such application, except in so far as may be necessary in order to secure the insertion in any Bill introduced into Parliament to authorize such purchase of clauses to protect their interests with respect to such purchase, and for that purpose the Company shall be at liberty to petition either or both Houses of Parliament, and to appear on such petition by counsel, agents, and witnesses, if they think fit; and if such powers of purchase be granted, the Company shall, within six months after the passing of the Act conferring such powers, sell and transfer, and the Council shall purchase and acquire, the undertaking of the Company, subject to all the existing mortgages, obligations, and liabilities of the Company in respect of, or affecting, their undertaking. Any such sale and purchase shall be for such price and consideration, and on such terms and conditions, as may be agreed upon between the Company and the Council, or as failing such agreement shall be determined by arbitration in accordance with the provisions of the Lands Clauses Acts, with reference to the purchase and taking of lands otherwise than by agreement, and in the construction of the said provisions the expression "the promoters of the undertaking" shall mean the Council, and the expression "lands" shall mean the undertaking of the Company. In addition to the sum to be paid by the Council to the Company under the foregoing provisions of this section, the Council shall pay to the Company all the costs and expenses of and incident to the arbitration, and the transfer of the undertaking of the Company, and the winding up of the Company, and also all the costs, charges, and expenses incurred by the Company preliminary to and of, and incident to, the preparing and applying for, and obtaining and passing of, this Act or otherwise in relation thereto. The Council shall also pay compensation to any officers and servants in the regular employment of the Company who shall not be retained by the Council in the same or similar office or employment, and at the salary and on the terms and conditions in, at, and on which they respectively were employed by the Company at the passing of the Act authorizing the purchase of the undertaking of the Company, in respect of any loss of office or diminution of salary or income by reason of the transfer of the undertaking of the Company to the Council, the amount of such compensation in default of agreement to be determined by arbitration as aforesaid, and no officer or servant who has been in the employment of the Company for ten years or upwards shall lose his right to compensation as aforesaid by reason of his declining to continue in the service of the Council. For the purposes of this section, the expression "the undertaking of the Company" includes all the gas-works, engines, mains, pipes and machinery, land, buildings, plant, and other property, and all the rights, powers, and privileges vested in, or belonging to, or had or enjoyed by, the Company at the date of the transfer of the undertaking of the Company to the Council, save and except: (1) The cash balances (other than consumers' deposits in the Company's hands or in those of their bankers or agents on the day of the transfer), and all sums standing to the credit of their reserve fund, and all undivided profits and all surplus stock-in-trade and stores not in use, which may be purchased by the Council at a valuation in the usual way. (2) All rents and profits of, and all book and other debts due to, the Company, and all rates accrued due on the date of the transfer, and the books and papers relating exclusively to the shareholders in and the constitution of the Company.

Excess Works—Bingley and the Gas Supply of Cullingworth.

The Bingley District Council Gas Bill (which contains a clause relating to the acquisition of the Cullingworth Gas Company, Limited) has passed through the Committee presided over by Mr. Heywood Johnstone. The circumstances of this purchase are a little out of the ordinary. In 1898, Bingley was extended; and the extension brought Cullingworth into the town. The consumers of gas in the latter district then thought their position a hard one, seeing that Bingley consumers only pay 2s. 9d. per 1000 cubic feet, while they have to pay 3s. 10d., with (in both cases) discounts. But a large proportion of the gas sold in Cullingworth by the Company is actually purchased from Bingley at 2s. 9d., and sold to the consumers at the higher charge. The shares of the Company were held entirely by persons in two large firms; but unfortunately about two years ago these firms fell into financial difficulties, and the share capital was placed in the hands of Trustees for the creditors. Negotiations thereupon took place between Bingley and the Trustees, and the transfer was arranged—the only question remaining between the parties being that of price. On two occasions during the consideration of the Bill, Mr. Ram, K.C., made an effort to get a clause inserted instructing the arbitrator to take into consideration the fact that the capacity of the works was larger than was necessary for present requirements, and sufficient to meet the demand for gas for a long time to come. The clause, he argued, could be so framed as to make it clear that the arbitration was not to be taken out of the operation of the Lands Clauses Act. That the works were in excess of the needs of the district was proved by Mr. E. H. Stevenson, who saw no reason why the clause should not go in. Mr. Waugh, for the promoters, strenuously opposed the proposal; and the Committee determined in his favour.

Mansfield Corporation Bill.

The Mansfield Corporation Bill, by which, *inter alia*, power is sought to purchase the rights of supply in the district supplied by the Mansfield Woodhouse Gas Company, has passed through the Commons Committee presided over by Mr. Bill. The Company is only a small concern with a paid-up capital of £1332 10s.; and they retail gas purchased in bulk from the Corporation. The Corporation Gas and Water Engineer, Mr. Arthur Graham, was present looking after the interests of his department.

Ilkeston and Heanor Water Board Bill.

The Bill promoted by the Ilkeston and Heanor Local Authorities to enable them to constitute a Joint Water Board for the purpose of acquiring a new source of water supply—the Meerbrook Sough—and to construct new works was the last Bill to engage Colonel Welby's Committee before the Easter recess; and although they then heard the parties patiently for three whole days, further time was required after the holidays to dispose of the measure. The room was as crowded as when the big scheme of the Derwent Valler Water Board was under consideration. This being the only Committee sitting the last two or three days before the recess, members of the Parliamentary Bar had nothing else to employ them; and so all who had been briefed concentrated their powerful intellects upon this one measure. It did not seem to the occasional visitor to the room that all this concentration had a happy effect. It should in such cases mean dispatch; but it has frequently a contrary influence—the more counsel there are, the greater the argument and examination, and this in its turn has at times the tendency of widening the disjunctiveness of parties. But in addition to the big array of Counsel, there was a substantial body of witnesses, both expert and local. Among the former, armed with their proofs, were noticed Mr. George Hodson and Dr. Percy Frankland, and Mr. Percy Griffith was looking after the interests of one of the opposing bodies, of whom there were several.

The Bill sought power to take all the water flowing in the Meerbrook Sough, which, by the way, is an artificial drain constructed in 1775 to relieve of water lead mines in the Wirksworth district. Opposition to the Bill was offered by millowners, the Corporations of Derby and Nottingham (who considered they would be affected by a reduction in the flow of the River Derwent, into which the Sough discharges from 14 to 19 million gallons a day), and the District Council of Wirksworth, on the ground that the water was obtained from subsoil beneath the town. A peculiar feature of the case was the question whether the water was underground water under *Chasemore v. Richards*, or whether it flowed in a defined channel. The Committee refused to adjudicate on this point. Mr. Littler, K.C., representing Wirksworth, claimed that it was true underground water, because anyone, by driving a drain or sough at a lower level, could appropriate the water without involving any penalty. The promoters, in opening their case, consented to take powers for only 4 million gallons per day; and subsequently reduced this to 3 millions. The Committee, in declaring the preamble proved, practically conferred the right to take the water; thus virtually treating it as water flowing in a defined channel. The Wirksworth District Council also secured clauses entitling them to take a supply for their own requirements, from any part of the sough in their district, out of the 3 million gallons per day allowed to the promoters. The case furnishes a striking example of the fearful expenditure imposed upon small authorities in preserving their water rights when these are threatened by wealthy Corporations. In this instance, Wirksworth, with a population of 4000 and a rateable value of only £10,000, incurred costs amounting to above £1000 in defending their natural rights.

Kettering Water Bill.

Numerous Counsel and opponents presented themselves to oppose the progress of the Kettering Water Bill before Colonel Welby's Committee; and four days were talked away principally over the interests of certain iron companies and millowners and the Rothwell District Council. One by one agreements were arrived at between the parties without the necessity of reference to the Committee; and in the end there was really very little left for the Committee to decide upon. The Bill was promoted by the Kettering District Council; and it is quite

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obvious that the scheme they propose to carry out is a wise and desirable one. The town possesses a population of 30,000; and of that number 10,455 are still supplied with water from private wells, many of which are shallow, and liable to contamination. The owners are gradually giving up these precarious sources of supply; and if the whole of the present population were connected with the town's mains, the Council's existing supply would be altogether inadequate. Therefore, it is proposed to carry out a new scheme of water-works, including two reservoirs, which will have capacities respectively of 140 million and 90 million gallons. For these and general works, the sums of £126,000 and £10,000 are asked for. The preamble of the Bill was passed; but the amount of compensation water which the Council are to give has been raised.

Llandrindod Water-Works Purchase. As successors of two Local Authorities who respectively in 1884 and 1893 obtained power to purchase the undertaking of the Llandrindod Water Company, the District Council are applying this session for the power to exercise the right under the new conditions, and to be authorized to extend the works and to raise for these purposes the necessary capital. At the same time the Water Company promoted a Bill for an extension of their limits of supply, additional capital, and new works. The two Bills came before a Commons Committee on Monday and Tuesday last week; and before the proceedings ended on the first day, the Committee announced that they should decide that purchase must take place on the basis of the 1893 Provisional Order. On Tuesday, it was agreed that the purchase was to be completed on or before March 1 next, otherwise the power to purchase will lapse. In view of this, the Company's Bill was, of course, withdrawn.

Burgess Hill Water Bill. The close proximity of Burgess Hill to Brighton has within the last few years acted very beneficially on the smaller place; and the process of development has been going on in a very satisfactory manner. In the prosperity, the Water Company have participated; and the natural outcome is that, to enable them to meet the requirements of the district, new works must be constructed. They have therefore applied to Parliament to confer upon them the necessary powers, including £30,000 of new capital and £10,000 borrowing powers, and authority to purchase the fee simple of certain lands now leased to them, and belonging to Lord Abergavenny. The estimated cost of the works is £24,300. The Bill was referred to the Commons Committee presided over by Mr. Fison; and they considered it last Wednesday. The Local Authorities of Burgess Hill and Cuckfield opposed, and asked (as local authorities are prone to do when a company who have shouldered all the uphill work have improved prospects before them) for the insertion in the Bill of a clause to enable them to come to Parliament hereafter for power to form a Joint Board to acquire the undertaking. The Committee were almost overwhelmed with evidence as to the excellence of the Company's supply, and the contentment of the inhabitants with it; and, in the result, Mr. Fison and his colleagues had no scruples as to the fairness of allowing the Bill to proceed without the purchase clause. They provided, however, for a reduction in the price of the water to the inhabitants of Burgess Hill. It is understood that Lord Abergavenny has reserved the right to put in an appearance in the Upper House in regard to the land part of the measure.

Rochdale Gas Profits.—The net profit of the Gas Department is about £7000 less than it was last year—£12,063, against £19,061. As £6000 was placed to the reserve account twelve months ago, and the Gas Committee do not propose to make any grant to that fund out of the present profits, the amount available for the relief of rates is only about £1000 less than last year. The reserve now stands at £17,283.

Ilkley Water Supply.—Considerable complaint has recently been made concerning the water supply to the Ben Rhydding portion of the Ilkley urban district. At the meeting of the District Council last Wednesday, it was reported that samples of the water had been submitted to analysts, who had pronounced it free from sewage or other objectionable contamination, and, in their opinion, suitable in every respect for drinking purposes.

Elland Gas Bill.—Negotiations have failed to bring about an agreement between the Elland District Council and the Gas Company regarding the Bill which the latter are promoting in Parliament. The Gas Company have definitely declined to entertain the offer of the Council to purchase the undertaking for £125,000, and active preparations are now being made by the Council to oppose the Bill in Parliament. The services of Mr. Baggallay, K.C., and of Mr. H. Lloyd have been retained by the Council; and Mr. Balfour Browne, K.C., will have charge of the case for the Company.

Mansfield Corporation Bill.—This measure was disposed of by a House of Commons Committee, consisting of Mr. Bill (Chairman), Mr. E. Wason, Sir G. Fardell, and Mr. Trevelyan. One of its provisions authorizes the Corporation to acquire what remains of the undertaking of the Mansfield Woodhouse Gas Company; and to this there was no opposition. The Corporation purchased the gas-works in 1878 for £37,500; and they have since been manufacturing gas themselves. But hitherto the distribution has been carried out in Mansfield Woodhouse by the Company. The Bill is intended to put an end to this arrangement; the Corporation having now entered into an agreement with the Company for the purchase of their rights. Mr. Boyce, on behalf of the Home Office, suggested that the Committee ought to satisfy themselves, as the purchase was to be on agreed terms, that the agreement was a reasonable one. Mr. J. H. Blake, Chairman of the Gas Committee of the Mansfield Corporation, was therefore called to give evidence on the point. He said it was proposed to pay the Company £2500 for their undertaking. Their capital was about £1300; but what the Corporation had considered was the question of profit. The Company's annual profit had been from £100 to £120, and £2500 was 25 years' purchase of £100. The Corporation were willing to pay this price, which they considered reasonable; and he thought the Company were also satisfied. The first price asked was £5000. The Committee approved of the clauses relating to the purchase; and the preamble of the Bill was passed.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills brought from the Commons, read the first time, and referred to the Examiners: Colwyn Bay and Colwyn Urban District Gas Bill, Horley District Gas Bill.

Bills read a second time and committed: Gravesend Gas Bill, Honley Urban District Council Gas Bill, Petersfield and Selsey Gas Bill.

Bills reported, with amendments: Bath Gaslight and Coke Bill, New Swindon Gas Bill, Shrewsbury Gas Bill.

Bills read the third time and passed: Bath Gaslight and Coke Bill, Chester Gas Bill, Otley Gas Bill, Sheffield Corporation Bill, Sutton-in-Ashfield Urban District (Water) Bill.

The Gas Orders Confirmation Bill, to confirm Provisional Orders relating to Horsham Gas, Nuneaton Gas, Pinner Gas, and Swaffham Gas; the Water Orders Confirmation (No. 1) Bill, to confirm Provisional Orders relating to Frimley and Farnborough District Water, Henley-on-Thames Water, Hungerford Water, South Staffordshire Water, and Wokingham Water; and the Gas and Water Orders Confirmation Bill, to confirm Provisional Orders relating to Bexhill Water and Gas, High Wycombe Gas, Portsea Gas, Slough Gas, and Woking District Gas, were presented on Monday last week, read the first time, and referred to the Examiners.

The Grangemouth Water and the Hamilton Burgh Provisional Order Confirmation Bills, to confirm Orders made under the Private Legislation Procedure (Scotland) Act, 1899, were presented last Thursday, and read the first and a second time.

The Barrow-in-Furness Corporation Bill, Broadstairs and St. Peter's Water and Improvement Bill, and Southport Water (Transfer) Bill have been referred to a Select Committee, consisting of the Earl of Jersey (Chairman), the Earl of Denbigh, Viscount Halifax, Lord Aberdare, and Lord Farrer; to meet on Monday, May 6.

The Harrogate Water Bill, Leeds Corporation Water Bill, and Ripon Corporation Bill have been referred to a Select Committee, consisting of Lord Hawkesbury (Chairman), the Earl of Buckinghamshire, Lord Barnard, Lord Mendip, and Lord Llangattock; to meet on Monday, May 13.

HOUSE OF COMMONS.

Monday, April 29.

LOCAL AUTHORITIES AND WATER UNDERTAKINGS.

Mr. PARKER asked the President of the Local Government Board whether the Government would consider favourably a proposal to authorize local authorities to compel water companies to sell their undertakings—the price to be fixed by arbitration in default of agreement; and whether they would support the repeal of the provision in the Borough Funds Act, 1872, which requires the consent of owners and ratepayers to be obtained to the promotion of, or opposition to, a Bill by a local authority.

Mr. LONG: The answer to the first part of the question must be in the negative. With regard to the second part, I am not prepared to say that no consent on the part of the inhabitants of a district should be required for the promotion of a Bill by the local authority, though I doubt whether such consent is necessary in the case of opposition to a Bill. My honourable friend the member for South Islington (Sir Albert Rollit) has before the House a Bill to amend the Borough Funds Act, 1872; and I am disposed to concur generally in the proposals in that measure.

Friday, May 3.

DERWENT VALLEY WATER BOARD BILL.

On the order for the consideration of this Bill,

Mr. J. W. LOWTHER (the Chairman of Ways and Means) called the attention of the House to the report of the Committee, which stated that a period of 60 years from March 25, 1909, for the repayment of certain loans had been created under the powers of the Bill; and moved: "That this House is of opinion that the allowance of a term of 60 years from March 25, 1909, for the repayment of the said loans is contrary to the spirit of Standing Order 173A of this House, but, having regard to the special circumstances mentioned in the report of the Committee, orders the Bill to be now considered." He pointed out that the Standing Order was direct and particular in this matter of repayment; but the Committee assigned as a reason for setting it aside the fact that the Bill dealt with a gigantic scheme involving the expenditure of £5,500,000, with the object of supplying water to the towns of Derby, Leicester, Sheffield, Nottingham, the county of Derby, and possibly part of the county of Nottingham. It was not for him to ask the House to overrule the Committee on that occasion, but he called attention to the fact that the Standing Order had been violated.

Mr. ELLIS said this was a very important matter, because the Committee were setting aside a mandatory order of the House. He held strongly the view that the Standing Order should not be set aside, except in cases of the most proved necessity. Local indebtedness was increasing, and so was the National Debt; and therefore it became all the more incumbent on the House to retain a firm hand in this matter of the repayment of loans.

Colonel WELBY (the Chairman of the Committee) explained that in 1899 there was a very important Water Trust created by Act of Parliament to serve a number of large towns. The Committee thought the simplest way, as this was not in any sense a new scheme, was to adapt the borrowing powers to those already granted in the Act of 1899, in order to facilitate the two measures being worked together as one united scheme. It was on this ground that the Committee recommended that exceptional powers should be granted.

Mr GRANT LAWSON pointed out that the case was gravely prejudiced by what was done in the last Parliament in connection with the Bill of 1899; and in that case a report was presented by the Committee which

was not accurate. It should be made clear that this was a wholly exceptional case, and that it must not be regarded as a precedent.

Mr. BARTLEY urged that the allowance of 60 years from 1909 was directly contrary to the letter of the Standing Order; and he accordingly moved to amend the motion of the Chairman of Ways and Means by striking out the words "the spirit of."

This was adopted. The resolution, as amended, was agreed to, and the Bill ordered for third reading.

DIRECTORS' VOTING POWERS.

Sir J. LENG asked the First Lord of the Treasury whether, in view of the declaration required from members appointed on Private Bill Committees, for the maintenance of the dignity of the House, and to relieve it from repeated discussions delaying public business, he would propose a Standing Order precluding directors of companies from voting on Private Bills promoted by companies of which they are directors.

Mr. BALFOUR: The honourable member appears to desire that the principle applicable to a judicial body like a Committee sitting on Private Bills should be applied to the House at large when they are dealing with these Bills on second or third reading. I do not know whether he desires that no member should speak or vote on a Bill in which his constituents are interested. I agree with the honourable gentleman that it is extremely inconvenient that there should not be a settled practice of the House in this matter. I do not agree with him as to the direction that settled practice should take; but I do agree with him that it should be settled one way or the other. I doubt whether an opportunity of coming to a decision upon this question will occur in the course of the present session.

Sir J. BRUNNER asked the right honourable gentleman to consider whether a declaration from him alone would not be sufficient to encourage a practice which would be approved by the House.

Mr. BALFOUR: I greatly doubt whether any declaration I could make would meet with universal approval. I have no evidence of that.

The following further progress has been made with Bills:—

Bill read the first time and referred to the Examiners: Chester Gas Bill [Lords].

Bills reported, with amendments: Aldershot Gas and Water Bill, Burgess Hill Water Bill, Devonport Corporation (Gas) Bill, Kettering Urban District Water Bill, Llandrindod Wells Urban District Council Water Bill, Mansfield Corporation Bill, Richmond Gas Bill, Stroud Gas Bill, West Surrey Water Bill.

Bill read the third time and passed: Horley District Gas Bill.

The Devonport Gas and Coke Bill and the Llandrindod Wells Water Bill will not be proceeded with.

The British Gaslight Company Bill, Metropolitan Water Companies (Amendment of Acts) Bill, and South Metropolitan Gas Bill have been referred to a Select Committee, consisting of Sir Henry Fletcher (Chairman), Mr. Strachey, Mr. Morris, and Mr. Tomkinson; to meet next Thursday, May 9.

The Golborne Gas Bill and the Rickmansworth and Uxbridge Valley Water Bill have been referred to a Select Committee, consisting of Mr. Caine (Chairman), the Marquis of Hamilton, Mr. Harmsworth, and Mr. Muntz; to meet on Thursday, May 9.

HOUSE OF COMMONS COMMITTEE.

Monday, April 29.

(*Before Colonel* WELBY, *Chairman, Mr.* LLOYD MORGAN, *Mr.* PLUMMER, *and Mr.* SOARES.)

MOND GAS BILL.

The proceedings on this Bill were resumed this morning.

Mr. BALFOUR BROWNE, K.C., Mr. WALLACE, K.C., Mr. BAGGALLAY, K.C., and Mr. GERALD FITZGERALD appeared for the promoters. The petitioners in opposition were represented as follows: Bilston Gaslight and Coke Company, by Mr. HONORATUS LLOYD; Dudley Gaslight Company, by Mr. ARNOLD STATHAM; Willenhall Gas Company, by Mr. PEMBROKE STEPHENS, K.C.; Wolverhampton Gas Company, by Mr. E. MOON; Midland Electric Corporation for Power Distribution, by Mr. C. F. PRITCHARD; West Bromwich Corporation, by Mr. RAND, K.C., and Mr. GREIG; Smethwick Corporation, by Lord ROBERT CECIL, K.C., and Mr. W. SHAKESPEARE; Walsall Corporation, by Mr. WEDDERBURN, K.C., and Mr. COURTHOPE MUNROE; Birmingham Corporation, by Mr. POPE, K.C., Mr. FREEMAN, K.C., and Mr. HONORATUS LLOYD; Oldbury Urban District Council, by Lord ROBERT CECIL, K.C., and Mr. W. SHAKESPEARE; Handsworth Urban District Council, by Mr. HUGO YOUNG, K.C.; Stourbridge Urban District Council, by Mr. C. C. HUTCHINSON; and Halesowen and Kingswinford Rural District Councils, by Mr. J. J. PARFITT. Counsel was reserved also on behalf of the Brierley Hill Gas Company and the Tipton and Sedgley Urban District Councils.

Sir *Frederick Bramwell*, cross-examined by Mr. PEMBROKE STEPHENS, said he could not give a definition of the term "producer gas;" but it was well understood by engineers. The Company would not compete with statutory gas companies in the ordinary use of coal gas—only as regarded gas delivered for power purposes. The Company would not deal in small quantities. There would be no sulphate of ammonia equal in value to that recovered by this process placed on the market by the gas companies. The Company expected to get from the manufacture of this gas as much sulphate of ammonia as would reduce the cost of coal by 75 per cent.

Mr. PEMBROKE STEPHENS: In addition to any competition there may be with the gas as to power, will there not be a very serious competition as to the production and sale of residuals?

Witness: Yes, and no. A gas company make sulphate of ammonia and sell it in the open market. This will simply be another producer of sulphate of ammonia, and will therefore be no more a competitor than any manure of equal value brought into the kingdom.

Apart from power gas and residual products, will there be any other form of competition?—None occurs to me.

Do the Company take power, among other things, to manufacture, sell, and deal in, and otherwise dispose of, engines, plant, fittings, machinery, and works of every description?—I had not remembered it; but I believe they do.

Those are precisely things to which the gas companies in the present day are more and more turning their attention?—If they are, they are departing more and more from the original purposes for which they were established.

Do you know that in the Company I represent, 31 per cent. of the gas manufactured is devoted to power purposes?—I do not. If there is to be any storage, it will be on a large scale. Probably the Company could do with two such holders as are to be found in South London, each of 5 million cubic feet capacity.

The principle of this scheme is that the gas is to be manufactured at the works, and sent into the pipes all ready on tap?—Yes.

Nothing in the nature of storage whatever?—That is not contemplated at present; and it will be idle to spend a large amount of money until we have found the need for it.

Are you looking to supply principally the large manufacturers, the small manufacturers, or the private people?—Not the private people. Principally the large manufacturers, because large manufacturers, although fewer in number, will take more gas; the smaller people if they choose can have it. It is intended chiefly for wholesale concerns.

Cross-examination continued: Certain large manufacturers could, and did, supply themselves with this gas without the assistance of the Company. It was open for any manufacturer to get Mond gas by obtaining the consent of Dr. Mond. The Company, if established, would not hurt the large manufacturer. If anyone was manufacturing gas in the district, the Company would be unable to interfere with him. In the future, manufacturers might have to apply to the Company for a licence. The patents had between 7 and 14 years to run; and when they had run out, the position of the Company would be the same as that of any other company who began to work under a patent. They would then be open to competition from everybody. The Company were not now asking Parliament for any particular power except to lay mains in the district. Even if gas supplied for power were turned into gas for illuminating purposes, there would not be a strong inducement to the Company to apply to Parliament to strike out the word "producer," and thus enable them to supply for lighting purposes—not even if they were on the verge of bankruptcy.

Mr. YOUNG suggested that the Company might well omit Handsworth from the scope of the Bill, seeing that there were very few factories there of the kind which the Company would wish to supply; and witness agreed that the district was largely residential. But there was no danger of the streets being broken up extensively for the sake of these few factories. The Company would not lay mains until there was something worth laying them for. If this district were cut out, "the biscuit might be nibbled all round until there was none left." If Handsworth had power to supply electricity, the Company would compete with them, so far as they supplied it for power purposes.

Mr. YOUNG: This Mond gas may be utilized, may it not, for working tramways?

Witness: I do not know the way. I wish I could invent it.

Mr. GREIG: Are you aware that in West Bromwich a large quantity of the gas they supply is at present used for power-producing purposes; and therefore, so far as gas is concerned, you may compete in West Bromwich?

Witness: Yes; probably your supply is to 5 or 6 horse power gas-engines. We should not care to compete there; but we should compete with your larger supplies of power.

If you were permitted to go into the district, you would take from the Corporation the opportunity of supplying electricity for power purposes?—The opportunity would be there; but I do not think many people would avail themselves of it.

Witness (in further cross-examination) said the specific gravity of Mond gas was about ·78. He had never seen the gas ignited at a long distance from the works, and cold. He should say there must always be positive pressure in the mains to supply the gas in a proper manner.

Mr. GREIG: How do you propose to get any positive pressure without a holder?

Witness: Conversely, in the same way that gas-works keep up negative pressure—by an exhauster. We shall have to use an exhauster as a compressor.

By Mr. STATHAM: He should say that for gas-engines there were other and better fuels than those made on the spot. With such engines, it would not be cheaper for the manufacturer to make his own fuel. Gas-engines were working more and more economically every day, as their horse power increased. He did not agree that where gas for fuel purposes was required, small, clean anthracite coal was the cheapest and best. That might work out to $\frac{1}{8}$d. per brake-horse-power. Mond gas only cost $\frac{1}{8}$d.

Mr. STATHAM: In contrasting the steam-engine with the gas-engine, may I put it to you that you are contrasting the very best class of gas-engine with the very worst class of steam-engine?

Witness: That is a fair observation. I do so because the worst class of steam-engine is so common.

Do you suggest that the whole of the capitalists—rich manufacturers having command of capital—in this district are running amuck of the right principle, and are using condensing motor steam-engines of 1000-horse power when they ought to use gas-engines?—Yes. They have not been taught the difference.

Is not this gas intermittent in its effect?—Not to my knowledge.

In further reply, witness said the experiments with Mond gas had not been extended beyond the supply for specific industries—where the power had been confined to a particular factory supplied from a particular works—to the supply from one source of a number of works of different classes requiring different quantities of power. No large undertaking of the kind suggested could be started, because of the want of parliamentary powers; but he had no doubt such a supply could be given. He could not say that the estimates were based on

analyses of slack which was not the slack of the district, and which must be imported. There would be two sorts of mains—steel mains where there was likelihood of subsidence, and ordinary mains where was no such likelihood.

Mr. LLOYD: Do you know of any precedent for a proposal such as this?

Witness: Yes; somewhat similar.

Do you know a precedent for handing over a district such as this to a company for the purpose of distributing a patented article?—I am not sure whether electricity might not have been in the category when a district was first given.

A district such as this?—No.

Do you attach importance to this being a patented commodity?—Not at all.

Then what advantage are the promoters getting by paying the £75,000?—That is for them to determine, not for me.

If you had attached importance to it as a patented commodity, it would be a little unfortunate that the patents have only a few years to run?—Yes.

That would be an important matter to consider?—Yes. The effect of passing the Bill would be to create an absolute monopoly in the district in Mond gas. No single manufacturer could make gas at the price the Company would be able to.

Counsel suggested that in America 27 attempts to p ish fuel gas had been made, and that 22 had utterly collapsed; while in two cases the promoters were endeavouring to get out of the business; and in no instance had a dollar been returned to the promoters. Witness, however, said he was not aware of the facts.

Mr. SHAKESPEARE: Do you suggest that the advantages which the Bill offers are sufficient to induce manufacturers to do away with all their boilers and engines, and to substitute plant capable of using producer gas?

Witness: In very many cases, yes; in some cases, no in new cases, always.

What is the special feature of Mond gas? There are many other gases capable of being used for creating power, are there not?—The special feature is the ability to turn the whole of the fuel into the gas or into the manure (sulphate of ammonia), and to deliver nothing but that, instead of ashes and tar, and all that sort of thing.

Does this mean that you recover from the coal a larger quantity of ammonia than by any other process?—Yes.

It was suggested to witness that the advantage in connection with the sulphate would disappear if the price of coal, instead of being 6s. per ton, was 10s. 6d.; but he said there would still be 4s. 6d. per ton recoverable.

Mr. MOON said the Wolverhampton Gas Company objected just as much as any other gas company to the scheme; but in view of earlier cross-examinations, he would not trouble the Committee.

By Lord R. CECIL: He should not think the cost of distributing the gas would be very great. In relation to quantity, the cost would be extremely small, because probably only the large consumers would be supplied. The capital cost for distribution purposes, however, he agreed, would be large. If a manufacturer were to supply himself with Mond gas, he would save that expense; but he would have to erect plant capable of making the gas, and turn himself into a sulphate of ammonia merchant. The very essence of the scheme was the relative prices of coal and sulphate of ammonia.

By Mr. WEDDERBURN: If they considered the ammonia, the gas was the bye-product. If they considered the gas, the ammonia was the bye-product. The Bill would largely increase the value of the patents. Questioned as to why other patentees should not have their patents also increased in value by Parliament, witness said they would have difficulty in convincing Parliament that they were for the benefit of the nation, as was the case here. The result of passing the Bill would be that, at the end of twelve years, this Company would have got invaluable rights in the district, and no one else would be able practically to supply Mond gas. This would be the ordinary case of a district given to a gas company. Walsall was on the outside of the district, and could be excluded from it without injury to other parts. If Parliament gave its sanction, persons interested in Dowson and Siemens gas, besides those interested in Mond gas, would be able to break up the streets in Walsall.

By Mr. HUTCHINSON: For the same quantity of heat or power conveyed in the gas, the mains would be twice the size of coal-gas mains. But he did not agree that the leakage would therefore be twice as great as with coal gas.

Re-examined: With regard to storage, each separate station was a continually producing unit; and it could vary its rate of production minute by minute as the need arose. So that there was not the same necessity for storage as with coal gas. To make more gas, all they had to do was to blow more air through the producer.

Mr. MORGAN: Is there any instance of Mond gas having been used for illuminating purposes?

Witness: None that I know of.

Lord *Kelvin* was the next witness, and said, in his opinion, the scheme of the Bill was perfectly practicable. This country had not much water power, and it was all the more necessary, therefore, that the cheapest power should be available in order that our manufacturers could compete with countries possessing large water power. Mond gas seemed to be invaluable for manufacturing purposes. In general, the use of gas in gas-engines was more economical than steam-engines. He had estimated that Mond gas could be supplied at 2d. per 1000 cubic feet. The figure might, however, be 1½d. or 2½d. The gas could be applied to making steel, reheating iron, annealing, &c., and to chemical works of all kinds. It was cleaner and much more convenient than coal, and its use prevented smoke; while the sulphate of ammonia obtained in its production would be a very valuable contribution to agriculture, as it contained more nitrogen than Chili nitrate, for instance. It had an active, pungent smell; so that it would soon be noticed if it escaped. There were great advantages in distributing gaseous, as compared with solid, fuel in factories. Cartage in the streets would be avoided; and in the works, it could be distributed by means of its own pipes and by its own pressure. He had seen the gas produced and used for various purposes, but not for illumination. It was a perfectly proper subject for an Act of Parliament.

Mr. RAM (in cross-examination): There is no respect in which you indicate that Mond producer gas is either more efficacious, or likely to be more successful, than other producer gas?

Witness: Yes; because this gas recovers the sulphate of ammonia, which none of the others do. The Mond system is entirely new, and different from the Siemens. Siemens gas would not be effective for a scheme such as the present.

Have you ever seen Mond gas ignited when cold?—Yes.

By the CHAIRMAN: It lighted when a match was applied; but the flame was not illuminating.

Further cross-examined: He advocated Mond gas because he believed manufacturers could work more cheaply and better with it than with existing fuel, and so face foreign competition more successfully. If desired, producer gas could be applied to winding engines and reversing gear. He did not admit that anything requiring instant variation in speed would not be very well worked by a gas-engine.

Mr. STATHAM: Are you, or any expert, in a position to judge of the commercial merits of the scheme until you have considered the relative cost of producing Mond gas on a large scale, as compared with the proved cost of producing other fuel gases, and until the cost of distribution, additional to the cost of production on the known scale, has been worked out?

Witness: I believe these two points are sufficiently worked out now to enable us to proceed on a perfectly secure basis.

By Mr. LLOYD: He thought there was not more than one form of Mond gas.

Mr. LLOYD: It was said that the promoters were willing to distribute a gas having, I think, not more than 14 per cent. of carbonic oxide. Is not the last patent one for providing a gas which will have 40 per cent. of carbonic oxide?

Witness: I did not notice that. The Mond gas that is to be supplied does not contain more than 10 or 11 per cent.

Mr. LLOYD: I know the Mond gas to be supplied may not; but I want to call attention to the fact that what is being licensed here is two sorts of Mond gas, one of which is said to contain 40 per cent. of carbonic oxide.

The CHAIRMAN said he understood a clause was promised providing that it should not be more than 14 per cent.

Mr. LLOYD: I am content to leave it there.

Witness, in reply to Mr. PRITCHARD, said, in his opinion, the gas-engine was a great deal cleaner and more convenient than a steam-engine with its fires and boilers.

Mr. PRITCHARD: Is it not the fact that electric motors would be still cleaner, and still more convenient, than gas-engines?

Witness: Yes. If electricity could be supplied for power at anything like the same price as Mond gas, it would be more convenient for manufacturers than a gas-engine.

By Mr. MUNROE: This gas was not made of lower calorific power in order to make more sulphate of ammonia, and so make more profit, while the consumer got less heat. The producer process kept the fuel and gases and everything concerned at a lower temperature than some of the other methods. It was in this process the lowness of temperature which allowed the sulphate of ammonia to be extracted. The sulphate of ammonia did not by any means depend on the calorific power of the gas.

Re-examined: If with Mond gas they could not reverse a gas-engine easily, they could throw the machinery out of gear, and in that way reverse easily.

Mr. MUNROE: Would Mond gas and the gas-engine be a suitable means of producing electrical power in this district?

Witness: Yes; the most suitable possible. Electrical energy for heating purposes could not be supplied at anything like the price at which Mond gas for the same purpose could be supplied under this Bill.

Mr. *Herbert Humphrey*, examined by Mr. GERALD FITZGERALD, said he was Engineer at Messrs. Brunner, Mond, and Co.'s works, and carried out their experiments in the application of Mond gas for the production of power. The gas was at present employed at Messrs. Brunner, Mond, and Co.'s works for a large variety of purposes. It was used for something like sixty different kinds of furnaces—ore burning, very largely for power purposes, evaporating liquids and acids, and all the various purposes requiring heat in connection with chemical manufacture.

Mr. FITZGERALD: Generally, are you perfectly satisfied with the results obtained?

Witness: Absolutely.

Both as to efficiency and economy?—Both.

You do not, however, use it for lighting?—No, we do not. We make our own illuminating gas with separate plant. We have some 5000 gas-burners; and if it could possibly be used for illuminating purposes, it would be made for that purpose—it would be enriched. But in spite of the fact that we have a large number of chemists, and have tried numerous experiments, we have found that it is totally unsuitable for that particular purpose.

So far, nobody, whether a chemist or an engineer, has discovered how to make Mond gas available for lighting purposes in your works?—No; they have not, and are not likely to do, owing to the amount of nitrogen and carbonic oxide gas that it contains. Carbonic oxide gas was non-inflammable. The heat developed on burning the gas had to go partly to raise the temperature of these products, and that did not raise the flame temperature enough to make it properly incandescent. With anything like 16 per cent. of carbonic oxide it was a hopeless task for anybody to try to render this gas fit for lighting purposes. The pressures adopted in America, as he found on visiting that country, for natural gas supply ranged up to 250 lbs. per square inch.

The CHAIRMAN: Does this natural gas chemically resemble Mond gas?

Witness: No; it is practically pure methane gas.

Further examined: The problem of the distribution and utilization of American natural gas much resembled the problem dealt with by the Bill. The pressures in practical operation in the United States

were far in excess of anything contemplated here; and, further, the lighting gas in the United States was also supplied at very much greater pressures than anything now proposed. Where the ground was liable to sinkage, the Company proposed to use an absolutely unbreakable main, made of riveted steel; the joints being such as would give as the ground gave.

Mr. FITZGERALD: Will you point out the chief advantages, in your opinion, which Mond gas has over the other kinds of producer gas known at present?

Witness: Mond gas is a clean, gaseous fuel of a very uniform quality, suitable for every kind of furnace work and for the production of high temperatures as required in many industrial processes. It has many advantages over all other kinds of producer gas known, among the chief of which are: (1) It is manufactured from cheap bituminous slack, such as is found in South Staffordshire. (2) Its manufacture is accompanied by the recovery of ammonia, amounting to about four times as much per ton of coal as is obtained in ordinary gas-works' practice. (3) It is consequently the cheapest of all gaseous fuels, as the value of the bye-products goes a long way towards covering the original cost of the coal. (4) It is the only producer gas prepared from cheap bituminous fuel, which has been regularly and successfully used in the production of cheap power by the use of gas-engines. (5) It is more uniform in quality than any other producer gas. (6) Ordinary producer gas contains most of the sulphur from the original coal; but recent tests of Mond gas show only about 12 per cent. of the sulphur of the coal, all the rest being removed in the process of manufacture. Mond gas is, therefore, of special value in the manufacture of the best qualities of iron and steel. (7) It is sufficiently free from tar and condensible products to be distributed through underground pipe-mains.

In further reply, witness said the gas would be manufactured in precisely the same way as in Messrs. Brunner, Mond, and Co.'s works at Winnington, where the system had been thoroughly worked out in every detail, and had been in use for a great number of years, with absolutely clockwork regularity and continuous success. To facilitate economical distribution, it would be compressed to about 7 lbs.—to 1·89 inches above atmosphere. At the branch-mains, the pressure would be probably reduced in order to ensure an absolutely uniform supply all over the district; and to do this, the pressure in the branch-mains must be independent of the pressure in the trunk-mains. There would be reducing valves at each branch-main. The consumer would not have it at more than 2 lbs. pressure, because the pressure in the branch-mains was limited to 2 lbs.; but within those limits, he would have it at what pressure best suited his particular purpose. The joints and mains would stand very much greater pressure than they would experience. The gas had a pungent smell, which would make its presence noticeable before an escape became dangerous. It usually contained 11 per cent. of carbon monoxide, which was an important constituent of water gas. This percentage was considerably less than was contained in most producer gases. In Mond gas, they relied mostly, or to a large extent, on the hydrogen for the calorific value; whereas most producer gases relied on the carbon monoxide for the heating value. There were some special features in the district the Company proposed to supply, which rendered it peculiarly suitable to the development of Mond gas. During recent years its prosperity had declined—one of the chief reasons being that the thick seams of coal, at one time plentiful, had now been largely worked out, there remaining only an inferior quality of fuel, which was not suitable, or so suitable, for the purposes of the manufacturers. This inferior fuel could, however, be used for the production of Mond gas. The district was eminently a coal and iron district; but there were also hardware, brick, glass, and other industries. The decline in the iron industry was mainly attributable to the fact that the more common introduction of steel had obliged the manufacturers of the kind of iron produced in this district to compete in a more restricted market. There was still a large quantity of coal of poor quality in South Staffordshire; and nothing would more benefit local industries than to profitably employ this coal, and give in return for it an excellent gaseous fuel. The calorific value of Mond gas was about 150 B.T.U. per cubic foot. Taking the heating value of Mond gas as 100, Siemens producer gas would be 80 to 90; Wilson gas, from 90 to 95; Dowson gas, from 95 to 100; while ordinary 16-candle power lighting gas would be about 400. Therefore, Mond gas was superior in heating value to other producer gases, and about one-fourth the value, bulk for bulk, of lighting gas. There was absolutely no doubt about the saving which resulted from the use of gaseous fuel. In the case of puddling and re-heating furnaces, the loss of iron through oxidation was reduced to about one-half by using it—thus saving several shillings per ton of iron in this way alone. Gas also had the advantage of being smooth and uniform; and it caused no smoke. Further, smoke and dust from solid fuel were of detriment in the manufacture of articles—like iron, bricks, glass, and pottery—which were treated in contact with a flame or products of combustion; but all such trouble would disappear with the use of a clean gas like Mond gas. A particular feature of gas-firing was that the temperature could be very easily regulated; and what was more important in the iron industry, was the fact that the flame, whether reducing or oxidizing, could be altered as desired. By the use of Mond gas, there would be a saving of time, not only because no time was lost in lighting fires and getting up heat, but because a given operation took less time with gas-firing. Most of the time now wasted in repairing furnaces would be saved. There would be economy in labour, because there would be no coal to handle and no ashes to wheel away. The furnaces would not require stokers; and labour in repairing furnaces would be very much reduced. Even where producer plant was already in use, the wages and upkeep of the producer plant would be saved by taking gas from the main. Gaseous fuel was much more uniform in working cost. It was difficult to conceive of any kind of fuel as regular as Mond gas. There was also great economy in regard to space in the use of gas as fuel. It obviated the need of boilers for steam-engines, stacks of coal, ash heaps, liquor tanks, &c. Summing up the advantages, he said the use of Mond gas would lead to a saving in fuel, in labour, in time, cost of repairs, and valuable space, as well as giving better results with less waste of material, all of which represented a large sum of money.

Tuesday, April 30.

Mr. *Humphrey*, further examined, emphasized the greater economy of gas-engines, as compared with steam-engines. He stated that at the Winnington works of Messrs. Brunner, Mond, and Co. they had working two of the largest gas-engines in the country—one being of 650-horse power, and the other of 450-horse power. Mond gas at 2d. per 1000 cubic feet worked out at about one-third of the average cost at which the 33 principal electric undertakings supplied energy in this country. The Mond gas-engines could be run for a length of time far exceeding anything that could be done in connection with coal gas. Thus, at Winnington, they had a Crossley gas-engine of 150-horse power which had run from the 25th of September, 1900, to March 16, 1901, without a single stoppage. He did not think that could be done with coal gas. He firmly believed that Mond gas could not compete with coal gas for lighting purposes. The supply of gas for power purposes by the West Bromwich Corporation was practically a negligible quantity. It would not pay the Mond Gas Company to compete with them, because their supplies were so small. West Bromwich was a type of other local authorities in the area. Even at 2½d. per 1000 cubic feet Mond gas worked out at about half the lowest price charged by West Bromwich. The Mond Company could supply large consumers at 1½d. to 2½d., and the small ones at from 2½d. to 3d.; and at these prices, the consumers would effect very considerable economy. The Winnington works turned out day and night considerably over a million cubic feet of Mond gas per day; so that this gas could not be said to be in the experimental stage. It had been used for years there; and had worked with clockwork regularity and absolute success. The same was true of another installation of Mond gas at Detroit, in the United States. Nor was the distribution of Mond gas in the experimental stage, because it was distributed from Messrs. Brunner, Mond, and Co.'s works to a distance of three-quarters of a mile, besides which the gas was supplied from the works to the Northwich Electric Supply Company, who used it for their engines. The area to be covered by the Company was really very small for a scheme of this sort, being considerably less than the areas covered by the Electric Power Companies who had been granted parliamentary powers last year. A scheme of this kind could only be made to pay, and command the attention and confidence of manufacturers, if carried out on a large scale. To restrict it to one place would be practically to restrict it to one particular industry; and thus the Company would suffer practically the vicissitudes of that particular industry.

Cross-examined by Mr. FREEMAN: The principal patent might be one granted in 1893; so that only eight years were unexpired.

Mr. FREEMAN: Does it not strike you as rather an extraordinary proposition to pay the enormous sum which is mentioned in this Bill for a patent that has so short a time to run?

Witness: If the patent had no life at all, I think Dr. Mond would be entitled to the sum, because he is supplying the whole of the plant and experience which is necessary to put up and run the stations successfully.

In further cross-examination, witness said he did not think that the majority of the works in the district were at present supplying themselves with gas; and he did not agree that manufacturers could supply themselves by the Dowson or Siemens process at from ½d. to ¾d. per 1000 cubic feet. That figure would not include anything for capital and labour. Mond gas would not be about three times as expensive as the rate at which manufacturers could supply themselves by either of the two processes mentioned. The estimated cost of distribution was £21,175, exclusive of fuel to drive the engines, or 0·249d. per 1000 cubic feet distributed. The average cost in ordinary coal-gas works was a little over 2d. per 1000 cubic feet.

Mr. FREEMAN: What is the cause of the enormous difference between your distribution and that of coal gas?

Witness: Chiefly because you have a very large network of mains compared with the volume through the pipes; secondly, your load factor is very small; and, thirdly, the quantity of gas per mile of main is very much less.

In further cross-examination, witness said the material used to manufacture Mond gas hitherto had been slack obtained from a number of different places. Fifty tons of it from South Staffordshire tried in the Winnington works gave most satisfactory results. Mond gas had been applied to steel in an experimental furnace at Winnington; but he did not know that it had been tried in the ordinary steel furnace. Taking Mond gas at 2d. per 1000 cubic feet, with 60 cubic feet per indicated horse power, the cost would be about ¼d. per horse power per hour. On the same engine, assuming a consumption of 2 lbs. of coal per indicated horse power per hour, the cost would be $\frac{1}{30}$d.; but Counsel made a mistake in assuming that coal for the purpose could be had at 6s. a ton. He did not know that any firms had agreed to take the gas.

By Mr. YOUNG: The districts of Perry Bar and Handsworth would not now be of much good to the Company; but one could not say how soon there would be works there. He should, therefore, object to excluding that district from the operations of the Bill. The figure of 6s. mentioned as the price of slack related to 1895. The price now paid was almost 9s. He did not believe the price had ever been higher than that.

By Lord R. CECIL: From a ton of coal, 140,000 cubic feet of Mond gas would be obtained. Provision was made for the use of 180,000 tons of fuel annually in the five stations; and the cost of the slack was put at £67,500, or 0·643d. per 1000 cubic feet. Undoubtedly the gas would be suitable for deep-mine pumping; and a witness would tell the Committee that he was going to take it for that particular purpose as soon as he could get it. The gas was suitable for all purposes where power was wanted. If used for reversing process, an extra piece of machinery would be required, which would mean loss of power. It was essential to make the gas at a low temperature, in order to recover the ammonia. It resulted in the production of a larger quantity of carbon dioxide, which would be a great drawback in the composition of the gas for fuel purposes, if a compensating return in the hydrogen were not obtained. At Winnington, they used coal to fire the boilers, because that suited their purpose better.

By Mr. PEMBROKE STEPHENS: He was in no way responsible for the

choice of the district. The estimated expenditure of the Company was £789,686, of which they put down for land and railway sidings £8000 per station, or £40,000; and £77,557 for works at each station, or £387,000—a total of £427,000, leaving for distribution plant the very big figure of over £360,000. There was nothing sticky in the gas; so that there would be no trouble in working the reducing valves in the distribution pipes. The Company were looking to all those who were prepared to take above the minimum quantity specified in the Bill—a million cubic feet per quarter of 13 weeks—as future customers.

By Mr. WEDDERBURN: The position of Wolverhampton was one of agreement, subject to their right to oppose in the second House if necessary.

Mr. BAGGALLAY: We have absolutely settled the heads of an agreement with Wolverhampton. It is merely now a question of drafting the clauses to carry out the agreement.

Mr. WEDDERBURN: If Wolverhampton likes to agree, we cannot make them wiser. Wolverhampton do not make their own gas; and the Wolverhampton Gas Company still oppose.

In further cross-examination, witness said Messrs. Brunner, Mond, and Co. had 60 steam-engines, and would continue to use them. They would linger in such works as those of Messrs. Brunner, Mond, and Co. The control of streets was of immense importance to local authorities; but he was not aware it was largely because of their desire to have absolute control of them that many local authorities had acquired tramway, gas, water, and electric undertakings. In the Lancashire Electric Bill last year, the boroughs of Manchester, Salford, Liverpool, Bootle, and Stockport were exempted from the operations of the Company.

Mr. BAGGALLAY said the exemptions in these cases depended on special circumstances. There was no general principle underlying them.

Witness said they could not compare those great boroughs with the local authorities in the South Staffordshire area.

Further cross-examined: There were more than seven kinds of producer gas. He agreed that the local authorities could not be expected to allow them all to break up their streets; they must take the cheapest. He did not think it would be better to wait twelve years until the Mond patents had expired, and so allow Mond gas to stand on its own merits. Mond gas was the most economical. It was generated at the cheapest cost, and was the most constant. He agreed with Sir F. Bramwell that Mond gas would not compete with coal gas used for small engines. Manufacturers could only supply themselves with Mond gas at 0·35d. where they had very large plant, as at Winnington; and then that figure would not include capital and other charges.

Mr. WEDDERBURN: Supposing you supply to local authorities in bulk, which I understand you object to——?

Witness: No.

Do you object to being limited to supplying authorities in bulk?—We will supply the local authorities in bulk to distribute to their customers.

Mr. BAGGALLAY: The only powers you have to distribute gas are under your Acts, which prescribe the candle power. Therefore you cannot supply Mond gas.

Mr. WEDDERBURN said they could apply to Parliament for power.

Mr. BAGGALLAY said they might do that.

Mr. WEDDERBURN (to witness): Do you object to being limited to supply Walsall in bulk, if they desire it, and to come under a provision not to supply otherwise in Walsall, except with the consent of the Local Authorities.

Witness: We will supply you in bulk, and agree not to supply anybody else in your area who does not take more than a given quantity of gas.

Are you ready to say that, without the consent of Walsall, you will not distribute in its district, but that you will supply Walsall in bulk?—No. We are willing not to supply for domestic purposes.

By Mr. RAM: He did not know that Mond gas had been used for iron or puddling furnaces. The result of the experiment with the steel furnace at Winnington was very successful. There were only four places in this country—the gas at one being used experimentally—at which Mond gas had been employed in the last twenty years. The supply of gas for power purposes by West Bromwich was 18,436,300 cubic feet in the year to March, 1900. In the year ending March last, it was 24,923,000 feet; but even that figure was only about 6 per cent. of the total.

Mr. RAM: To whatever extent this fuel gas will compete with the power supplied by the West Bromwich Corporation gas, it is a serious thing for the Corporation?

Witness: It just depends on the extent of the competition.

Do you doubt that, if this fuel gas is as good as you say, it will extinguish the sale of ordinary gas for power purposes?—No; only for comparatively large power purposes.

We supply for fuel as well as for power. Will it extinguish our sale for fuel?—It will not touch cooking-stoves, which, I take it, is the bulk of your fuel supply.

Can you give me the minimum which it will pay you to supply?—We take it that the figure in the Bill is sufficient for that purpose—a million cubic feet per quarter.

Cross-examination continued: Dellwik water gas was in use at West Bromwich. The ordinary cost of water gas per 1000 cubic feet was about 3d.; but that was without capital charges. That 3d. would not contrast with the 2d. for Mond gas, because the two figures did not include the same items. The figure of 0·35d. for Mond gas—the cost at the Winnington works—would compare with the 3d. The 3d. would become 18d. when all necessary charges for capital, enrichment, &c., were added. Dellwik gas had rather less than twice the heating power of Mond gas.

By Mr. STATHAM: Mond gas would light when cold. After lying in a pipe for twelve hours at 32° Fahr., he was certain it would light.

Mr. STATHAM: If I call scientific evidence to prove that if this gas is distributed through the mains to districts, and has lain in the pipe for twelve hours during a frost, it cannot be lighted, do you say that has nothing to do with the case?

Witness: It is absolutely impossible; the thing is absurd. At Winnington, gas had passed through a frozen main to a furnace, and when turned on had always ignited. A number of people in South Staffordshire had said they would take the gas as soon as the Company were ready to supply.

By Mr. PRITCHARD: He anticipated that, on an average, gas-engines of from 20 to 200 horse power would be used in South Staffordshire. He thought the manufacturers would substitute large gas-engines for their steam-engines.

By Mr. MOON: He had had no experience of gas distributed under the conditions which would apply to this gas. He assumed that the cost would be very much less than that of ordinary coal gas; and he had every reason to believe that assumption was correct.

Re-examined by Mr. BAGGALLAY: There was absolutely no foundation for the suggestion that there would be any difficulty in lighting the gas in winter time; and if there was anything in the suggestion, it would apparently cut away the ground from under those who said the gas would compete with gas supplied for illuminating purposes. Mond gas was now being used at the Northwich Electric Supply Company's station, at Messrs. Crossley's, at the Premier Gas-Engine Company's works, at Messrs. Brunner, Mond, and Co.'s works—where fully 25 million cubic feet a day were consumed—at the Solvay Process Company's works, Detroit, at a glass-works at St. Helens, at the De Dion works, Paris, and at the Farnley Motor Company's works. It would be quite impossible for any private person to obtain producer gas at 0·35d. The Company only expected to get about 1000 customers; so that, the capital being £1,000,000, they were proposing to spend £1000 on each. It would be a serious thing if portions of the district were cut off. The Company expected there would be works wherever there were railways and canals, as was the case at Walsall. If portions of the district were cut off, it would upset all calculations with regard to the stations, the positions of which had been carefully selected so as to be in the centre of the demand, and able to assist one another. He believed about 4 million tons of fuel were burnt in the South Staffordshire district per annum; but the Company would only use about 5 per cent. of that quantity. So that the amount of fuel which the Company would consume would be altogether out of proportion to the quantity which would be saved by the use of Mond gas for fuel purposes.

Mr. SOARES: I do not quite understand why you do not use this gas for your own steam-engines at Brunner, Mond, and Co.'s works?

Witness: It is because we require the use of exhaust steam as a heating agent in the works—for distillation purposes principally; and that necessitates our using steam in very large quantities in any case. So we raise steam at high pressure, pass it through our gas-engines and pumps, and then use the same steam for purposes of heating.

How long have you been using Mond gas at Winnington?—For furnaces, I should say we have been using it there for fifteen years.

You do not use it, I understand, for working the pumps?—No. The whole works are interlaced with a series of exhaust pipes, into which all these various steam-driven appliances deliver. Where we are isolated, of course, we use gas-engines.

Wednesday, May 1.

Professor *Dewar*, examined by Mr. WALLACE, said he had heard the evidence given by Sir F. Bramwell and Lord Kelvin; and he agreed with it.

Mr. WALLACE: As to the economy of gaseous fuel?

Witness: I think there can be no doubt upon that question. It has been before the scientific world for the last twenty years. No man has done more than Dr. Mond to bring this before the English public. In the last twenty years he has been improving, patenting, and elaborating until you may say that Mond gas is the survival of the fittest.

What do you say as to the practicability of Dr. Mond's process to produce gas?—Mond gas is characterized by containing a larger percentage of hydrogen, and a smaller percentage of carbonic oxide, than other producer gases; but you must understand it has other advantages. It is a gas that is washed and cooled, and contains a very small proportion of tarry matter. Unless it had all these properties, it could not be conveyed in pipes economically, nor used properly in gas-engines. Mond gas is the only producer gas made from bituminous fuel that can be represented as the survival of the fittest. Producer gas may be defined to be a gas produced by the combined action of water and air upon coal or bituminous matter; and the variation of the gas depends upon the structure of the transformer, the temperature at which it is done, the mode in which the reaction is effected, and the subsequent treatment of the gas. In the case of Mond gas, it would never pay unless the sulphate of ammonia was recovered, because the cost of washing and cooling and separation of the tar would make it impracticable. With all other producer gases, unless you economize the ammonia, it would be impracticable to cool, wash, and purify the gas to the same extent. The chief object that Dr. Mond has pressed before the chemical world for the last twenty years, and more especially since 1893, has been to try and render this country independent of any other country for the supply of nitrogenous manure. If we could supply the amount of ammoniacal salts we require, we should be independent practically of any other country. He has pointed out that if we could utilize the ammonia in the way that he proposed, with the enormous quantity of coal consumed in this country we should produce all the ammoniacal salts we require. Continuing witness said Mond gas was characterized among all producer gases by containing a less percentage of carbonic oxide.

So that you can get within the limits required by Government?—Yes; 10 or 11 per cent. quite easily. The physical properties of the gas were such as would enable it to be easily distributed. It might be regarded almost as a permanent gas.

On further examination, witness said the difference between a producer gas and any form of coal gas or water gas was that producer gas always contained nearly 50 per cent. of nitrogen, whereas coal gas only contained 4 or 5 per cent.; while water gas was free from nitrogen altogether. The suggestion that the gas would not light if frozen was ludicrous; but in order to satisfy the Committee, he subjected some of the gas to a freezing process, and found, on applying a match, it burnt perfectly well.

Mr. WALLACE: It has been suggested that this gas is suitable for illuminating purposes. What do you say as to that?

Witness: I maintain that there is no gas—no permanent gas—that you cannot say can be made an illuminating agent by two means. Either you charge it with some hydrocarbonic vapour, or you might take a gas that burns with a non-illuminating flame and place a solid body in it, as you do in the Welsbach mantle. You get a certain amount of light in both cases. But the question is as to the efficiency and desirability, and the cost.

Would there be any advantage in taking the Mond gas and treating it in that way?—It would be too stupid. It would be the same thing as if you took the most inferior kind of coal gas that you can produce and mixed it with a volume of nitrogen, which is an absolutely inert substance. The temperature of this gas is below that at which you would get much luminosity. To use coal gas for the purpose of the illuminating mantle you speak of, it is made illuminating by the use of a bunsen burner, by mixing it with the amount of air required. Then you get a high temperature of the flame; and a solid body placed in it will emit a large amount of light. You get a small amount of light from producer gas if you put a solid body in it. In order to get the temperature of 2000°, it would require to be enriched, and then it would be too costly.

Cross-examined by Mr. WEDDERBURN: In the case of an incandescent mantle, it is the mantle that gives the light—that is to say, the solid body. Any solid body raised to a temperature of about 1500° C. begins to emit light; and the extraordinary thing is that all solid bodies begin to emit light at about the same temperature. This gas has a much lower temperature than any form of coal gas, because there is 50 per cent. of nitrogen in it. There is no nitrogen, practically speaking, in the most inferior forms of coal gas.

Mr. WEDDERBURN: Is it not conceivable that you might get a mantle incandescent, or capable of being made incandescent, to such a degree that it would give a sufficient amount of light?

Witness: We know of none at present. But this gas, for other reasons than its low temperature, could not be used effectually.

Why?—Because it produces a deposit on the mantle—it clogs the mantle.

You pointed out that Dr. Mond's great object was to provide this country with as much ammoniacal product as possible, in order that it might be independent of other countries?—That was one great object; but the other great object was the economy of our coal supply, and the production of gas for manufacturing purposes—that is to say, the energy—at the cheapest possible rate.

In cross-examination by Lord ROBERT CECIL, witness said, as to the impurities which might be deposited by this gas, that it contained some traces of sulphur, and minute traces of iron. One of Dr. Mond's most remarkable discoveries was that carbonic oxide can combine with iron under certain conditions, and produce a gaseous body which contains iron; and this carbonic iron compound will, when it is heated, deposit iron again. It was possible that the gas might contain minute quantities of an iron compound of this kind, and deposit it on the mantles. All he could say was that it did produce an effect of that kind. The character of the gas has been fully investigated, not for minute scientific purposes like the incandescent question, of which nobody even heard until it was raised in this Committee-room. Any gas could, of course, be used for heating a mantle; but no man in his senses would employ this gas for the purpose, having regard to the number of mantles which would be required, the cost of the installation, and the attention which would have to be given to the light.

Lord R. CECIL: You have not tried any experiment?

Witness: I have made the experiment merely in the laboratory, to satisfy myself that it is an agent that no one would dream of using for lighting if he could get any form of coal gas, or have any installation of coal gas. The advantage of the Mond gas is that it also contains a relatively high percentage of carbonic acid or carbon dioxide. This dioxide is in the same position as the nitrogen. You might say that the 5 per cent. more of carbonic acid in Mond gas is balanced by its containing less nitrogen. Of course, it is more than balanced by its containing more hydrogen. I should think it contains a little less nitrogen. The percentage of nitrogen in Mond gas is 47; in the Siemens producer gas, 59·4; in the Dowson gas, 48·98; and in the anthracite, 49·5. So that they are all slightly higher than the Mond gas. Mond gas contains 5 or 6 per cent. more carbon dioxide than the other gas. I know Duff gas as one of the producer gases. It is of the same type as the Mond gas. The object there is the same as in the case of Dr. Mond's gas.

Cross-examined by Mr. GREIG: He could not admit that Mond gas was a bye-product. In 1893, Dr. Mond put the character of the gas in the forefront as follows: "Improvements in obtaining combustible gases, ammonia, and tar from fuel, and any apparatus therefor." There was very little chance of common air getting into the mains when the valves were shut—much smaller than in the case of coal gas. The proportion of common air and ordinary gas necessary to make an explosion would be five or six volumes. The explosive power of coal gas mixed with air was very much greater than that of Mond gas mixed with air. This gas was a mechanical mixture of one of the lightest gases, hydrogen, and the heaviest carbon dioxide. They did not propose to apply the principle of regeneration to the working of an incandescent mantle. A small trace of impurity in these mantles often produced a fatal result; and he said no one had imagined the application of Mond gas for these. A trace of iron was fatal to the Welsbach mantle, diminishing its emissivity of light enormously. The manufacturer who wanted a higher temperature than would be produced in the ordinary mixture of air and Mond gas, could get it, if he desired, by the well-known process that everybody would now use—namely, the generation. Mond gas was so effectually washed that the tar was all separated. It had to be elaborately washed—first in order to cool, and then to take out the ammonia.

By the COMMITTEE: There was less danger of explosion from this gas than from ordinary coal gas. Mond gas mixed with air would not give a pressure above 5 or 6 atmospheres in a closed vessel; and if one took coal gas it would produce 12 to 15 or 16. Take the two gases; mix the exact amount of oxygen required for complete combustion and no more; compare the pressure produced; and, in the case of coal gas, the explosive effect would be 5 or 6 times greater.

Further cross-examined by Mr. GREIG: He had never heard that where Mond gas had been used—the plant working—the great trouble in the production of it was the tar.

Mr. *H. E. Jones* said he knew the district covered by the Bill. He had visited it professionally, and had lived at Wolverhampton. He had examined the estimates in the scheme for the distribution of the gas, and he considered them reasonable. They were quite ample to cover all cost, because the distribution of the minimum quantity for the consumer here was very many times larger—a hundred times larger—than ordinary, or, as he might call it, retail scale, on which they worked in coal gas. The distribution would be accomplished by an exceedingly short length of distributing main pipes—he thought some 83 miles. With ordinary gas distribution, the mileage would be many times greater. The average consumer of Mond gas was reckoned to take 25 million cubic feet, as against 10,000 cubic feet of coal gas for power. He believed the estimates made in this case were much in excess of what they would find necessary. Up to 30 or 40 horse power gas-engines were undoubtedly cheaper than steam. Beyond that they were not cheaper, unless one made producer gas. In the east of London, directly a user of power got up to the scale of over 50-horse power, he would put up a Dowson gas plant. Mond gas could not be supplied to the same class of customers as the gas companies served; it would ruin the Company. The province of the two gas suppliers was entirely distinct. Ordinary illuminating gas was the best for the production of power—the Mond people admitted that it gave four times as much power; but no one could supply coal gas in this country at much less than 1s. 10d. to 2s. per 1000 cubic feet. If one put 4½ times the 2d. or 3d. spoken of in the Bill, it only got up to 9d. or 10d., as against 1s. 10d.; and that carried the whole thing. No one in his senses would think of smelting iron with coal gas at 2s. per 1000 cubic feet. The Mond Company could not supply gas for small engines in houses or for domestic cooking; it would ruin them. Knowing the trade of the district, he should say there was a great field for it; and a great economy to be realized by the substitution of it for coal. With regard to the cost of distributing ordinary illuminating gas, about 3d. per 1000 cubic feet was absorbed in interest on capital involved in service pipes; 1d. to 1¼d. for renewal of mains and service pipes; and ½d. or ¾d. for taking the indices of the meters (which were many thousands against the smaller numbers here). So that from 5d. or 6d. would be about the total. That made it absolutely impossible to supply gas at anything like a cheap rate in the quantities required by the manufacturers of this district. Leakage in large quantities was caused by a fracture or a joint failing. The bulk of the normal leakage came from an infinite number of very small and not detectable oozings, so to speak, of gas in a great number of places spread over a large system of mains. It was connected with the large number of small consumers; large amounts not being lost from the great trunk mains. There was also leakage from the gasholders. These leakages would not take place with regard to Mond gas. An advantage of the high pressure at which it would be supplied, would be that any fracture or leakage would show itself immediately.

Mr. WALLACE (who continued the examination of the witness): I want to ask you about the qualities of Mond gas for illuminating purposes?

Witness: There are two ways of making water gas luminous which I am more familiar with than this. One is to enrich by adding carbon in some way. The other is to use it with a mantle—Dr. Welsbach's mantle—which becomes incandescent with the heat. The first process is expensive. It adds to the raw cost of the gas from 9d. to 1s. 3d. per 1000 cubic feet, according as you want 14, 18, or 20 candle power gas. The other requires that the gas shall have a very high calorific power at the edge of the mantle, to make the mantle luminous. With regard to Mond gas, its constitution being nearly half air, or the main constituent of air (nitrogen), I am confident that the test would be more than that of water gas, which already contains some carbon; and with regard to the heating of a Welsbach mantle, by reason of its calorific power—less than one-fourth that of coal gas—I am satisfied, in my own mind, that you could not make a mantle luminous with it.

Do you see any substance in the objections from the point of view of a gas manager?—I see no reason for the petitioners' alarm.

Is this an entirely different commodity from that you have been supplying all your life?—Yes, absolutely; and I would not thank Parliament to put me under the obligation to supply it, coupled with the prices mentioned in the Bill.

In further examination, witness said that if the Mond Company were put under obligation to supply the smallest consumers, even at the maximum price of 4d. per 1000 cubic feet, the scheme would be ruined. The natural line of demarcation was that the Company should supply only the large consumers, for heat and power and for other purposes, who at present did not come, and never would come, to the coal-gas company for gas.

Cross-examined by Mr. RAM: It would not be cheaper for customers to make Dowson gas on their own premises rather than take the Mond supply. At Millwall, four or five people were doing that now. It cost them about 6d. per 1000 cubic feet; whereas Dr. Mond would supply them, having regard to the quantity they used, at about 3d.

Mr. RAM: Having regard to what the cost is at West Bromwich, if West Bromwich had the advantage of your advice, should you view with equanimity the idea of Mond gas coming in there?

Witness: Yes; because with their 5 per cent. discount they cannot get below 17d. per 1000 cubic feet. They cannot do for less than 17d. what Mond can do—multiplying the price fourfold to bring his gas up to your level—for 9d.

Is not that the very reason why you should view it with apprehension?—I cannot expect a man to give up using his coal or his steam or Mond gas, or Dowson gas to burn my gas at twice the price.

Cross-examined by Mr. LLOYD: Dowson gas beat him at Millwall to-day. By that, he meant that the man who had large use for power would ask him to sell coal gas at 40 per cent. discount; and on being told this could not be done, he immediately set up plant on the Dowson principle.

Mr. LLOYD: That means that you are suffering to-day from competition by fuel gas?

Witness: If you like to put it that way. I should rather say the

steam-boiler maker or the steam coal seller is suffering. Mind you, I never had his supply. He takes nothing from me.

In further cross-examination, witness said he did not think this sort of competition would be extended enormously over the South Staffordshire district if the Bill were passed. Gasholders were neither necessary nor advisable for the supply of Mond gas. The cost of distribution would be about ¼d. per 1000 cubic feet, apart from interest on capital. The same expenses of an ordinary gas company would be about 1¾d. He was not surprised at this difference, because they were going to sell fifty times the amount of gas over the same mileage of pipes.

Cross-examined by Mr. PEMBROKE STEPHENS: The new gas would not compete in the Willenhall Gas Company's district, because the consumers of coal gas for power or heating purposes were so small that the Mond Company dare not think of supplying them.

By Mr. COURTHOPE MUNROE: He did not know a gas company, but he knew two works—those at Wapping and one of the stations of the South Metropolitan Company—which had no storage. Both Companies, however, were connected with other gas-making stations. A coal-gas company usually needed storage, because it had to store gas made in the daylight and send it out in the hours of darkness. Mond supplied during the hours of daylight as fast as he manufactured.

Mr. *J. B. Cochrane* said he had been to Winnington, and was very pleased with the Mond gas, which he thought was the gas for the purpose required in connection with the Mines Drainage Commission. He concluded that the Mond gas for pumping would be a great economizer of fuel, and in other ways be economical. The welfare of the district depended on the supply of cheap fuel. At a meeting in Birmingham, at which there were about 200 representatives of the leading manufacturers of the district, the following resolution was passed: "In the opinion of this meeting, the introduction of the Mond gas system for power and heating purposes, but not for illumination, from central stations would be a great advantage to the industries of the South Staffordshire district, and should be encouraged by manufacturers, local authorities, and others who take serious interest in the welfare of the district."

Cross-examined by Mr. GREIG: The inception of the present scheme arose out of the General Manager of the Mines Drainage Commission approaching the promoters. Dowson gas would not suit their requirements as well as Mond gas. The Commission were not practically offering Dr. Mond £75,000 to save their concern.

Mr. *John Knowles*, Mayor of Wednesbury, said Mond gas would be a godsend to the various trades of the district—such as railway axles, bridges, iron tubes and fittings, edge tools, coach ironwork, and foundry work.

Cross-examined by Mr. GREIG: The Wednesbury Corporation did not supply, and therefore this new gas would not compete with them. The Corporation had settled with the promoters as to clauses in regard to breaking up the streets.

By Mr. PEMBROKE STEPHENS: The Wednesbury Corporation were anxious that the gas should be brought into their district.

By Mr. STATHAM: The chief works of the town were the Patent Shaft and Axle Works; and the management, a fortnight ago, said that, when the new system was complete, they would be glad to take some Mond gas. There were a good many other works in Wednesbury which would like to take Mond gas. He thought an arrangement had been made by which the Corporation could take the gas at so much per 1000 cubic feet, or in bulk.

Mr. *G. K. Harrison*, of Messrs. George King Harrison, colliery proprietors and fire-brick and gas-retort manufacturers, of Stourbridge, said his firm employed about 400 men, and consumed from 400 to 450 tons of slack weekly. Mond gas was suitable for the manufacture of bricks, and for working the engines in connection with mixing clay, &c. He saw no reason why they should not burn fire-bricks in kilns with Mond gas. He asked Dr. Mond if he could scheme for him a producer plant to deal with 150 tons of slack per week; but Dr. Mond said the smallest he would advise was one consuming from 150 to 200 tons of slack daily. That being so, witness did not erect the plant; but if the Company would supply Mond gas, he would at once alter a kiln, or build a new one, and try to use the gas.

Cross-examined by Mr. PEMBROKE STEPHENS: To take Mond gas would involve the alteration of every separate kiln; and the stoves for the heating arrangements would also have to be altered. But the advantage would be that they would save the labour. All firms who took the gas would have to readjust their works. He expected to get the gas for 2d. per 1000 cubic feet.

Mr. *J. S. Williams*, a flint glass manufacturer, of Brierley Hill, employing about 300 hands, and burning about 100 tons of coal and slack weekly, explained the method of manufacture in the glass trade. If they had Mond gas, they would be able to control the heat, and so save a considerable loss to the trade. The gas would go far to revive an important industry which was suffering severe depression. If he could get Mond gas, he would at once have one of his two furnaces adapted to its use.

Professor *R. Threlfall* said South Staffordshire was now beginning to feel the pinch of the want of coal, and apparently the only way of meeting this was by something in the way of co-operation. The people of Switzerland had been able to co-operate in distributing water power. We had no water power to distribute; but we could distribute gas. The advantage in this district arising from the use of Mond gas would be that the consumption of coal would be diminished, and therefore the deposits of coal would last longer.

Mr. WEDDERBURN (in cross-examination): The real question here is whether the convenience to the manufacturer is to over-balance an inconvenience of another kind—say, to the local authority with regard to the streets and other things. It is merely a question of balance of convenience?

Witness: I think it goes rather farther than that. The local authorities can only represent anything as long as there is something to represent. The whole district depends on the manufacturers; so that if they go down, I do not see what the local authorities can do.

Thursday, May 2.

Sir *Alfred Hickman*, M.P. for Wolverhampton, examined by Mr. WALLACE, said he was Chairman of Sir A. Hickman, Ltd., who owned steel works, blast-furnaces, and collieries in South Staffordshire. He was also the proprietor of another colliery and a brickworks. He thought that in the near future producer gas would be used for driving engines generally, and also for steel-furnaces. He had had producer gas in his works for some time past; and the effect had been to reduce the cost of fuel for heating the steam-engines to one-fourth what it was previously. The producer gas he used was called a new form of Siemens furnace gas. With producer gas slack was used, which was much cheaper than the coal with which iron was usually heated in furnaces; and smaller quantities of it were required. With coal, the metal was exposed to an oxidizing flame, which was avoided by the use of gas. Gas also caused much less waste; and with it steel was less likely to be burnt.

Mr. WALLACE: As a result of your experience, you are now putting down much larger gas-engines than you had before?

Witness: I am just putting down a pair of 500-horse power gas-engines, which will be supplied in about a fortnight. They will be driven by gas direct from blast-furnaces.

If this gas were supplied, would it assist the other manufacturers in the district in their processes?—Most materially, in my opinion

Would it do to postpone this privilege till the expiry of the patent, as has been suggested?—I think it would be a great misfortune. No doubt, certain industries in South Staffordshire are now declining; and unless they obtain some assistance before the end of twelve years, they will probably die out.

You are not interested in the promotion of this gas?—No.

Examination continued: At the meeting of manufacturers at Birmingham, all the great industries of the district were represented; and the resolution in favour of Mond gas was passed unanimously. He believed Mond gas would benefit every industry in the district. It would cause such an increase in the trade and manufactures, that even the coal-gas suppliers would be benefited.

Cross-examined by Lord R. CECIL: He could not tell what Siemens gas cost. The engines of 500-horse power were only an experiment. If successful, he would drive the greater part of his machinery by such engines.

By Mr. STATHAM: In his works there were approximately thirty boilers. Of these about one-third were worked by coal or slack; the other two-thirds being worked by gas. If Mond gas were available, he thought it extremely likely that the undertakings with which he was connected would abandon existing plant and use the new gas for the boilers, for which they were now using slack.

Mr. *R. Armitage*, one of the Managers of the Farnley Iron-Works, Leeds, said his firm were putting up a large plant for bye-products recovery under the Mond process. They found gas most successful for welding. The quality of iron they produced by using this gas was most satisfactory. He had studied the question of burning bricks with gas, and had examined kilns in America, Scotland, and on the Continent; and he had come to the conclusion, after trying Mond gas, that it was the most suitable fuel for burning, and likely to be most economical. The experiment which his firm tried before adopting the gas was on a large scale—the production of about 50,000 cubic feet per hour.

Cross-examined by Lord R. CECIL: His firm were proposing to put up plant for ten large producers; and they were starting with four. The result of the use of Mond gas was so satisfactory, that they were proposing to spend £30,000 on Mond gas producer plant.

Mr. STATHAM: What you hope to do is to make profit by the recovery of the sulphate of ammonia?

Witness: That is part of the thing; but not the whole.

What started you upon this new development? Was it the idea of recovering the sulphate of ammonia and selling it?—No; what we wanted was a washed, clean, cheap gas.

Have you taken into calculation the question of getting a washed, cheap, clean gas, or the question of economy?—Both. We wished to produce our manufactures at the lowest cost.

What proportion is the fuel cost of the general cost in the manufacture?—The fuel cost in the manufacture of fire-bricks is a very large proportion.

Therefore, it would pay you very much better to manufacture your own gas than to take it from a company at the prices fixed by such a Bill as this?—We could only do it by having a big works, and putting up a large plant to manufacture our own gas.

Mr. *Sclater*, Engineer to the Northwich Electrical Supply Company, said his Company used Mond gas to produce electricity; the gas being supplied from the Winnington works of Messrs. Brunner, Mond, and Co., about three-quarters of a mile away. Their dynamos had been running absolutely smoothly; and, as far as they could tell, the gas had been uniform in distribution. They had had no trouble from tar. They had been running for three years and five months, and had never yet found it necessary to take out a piston. The deposit from the gas was very small indeed. From his experience of other electrical works, he should advise all producers of electricity to use Mond gas.

Cross-examined by Mr. GREIG: When he said the engines had been running for three years and five months, he meant without breakdown or stoppage for repairs. The gas-main was about 12 inches diameter. The price paid for the gas was 2d. per 1000 cubic feet; and the consumption last year was over 20 million feet.

Mr. PRITCHARD questioned witness as to the relative cost of an electrical motor and a gas-engine using Mond gas, and witness said the cost per brake-horse-power, with Mond gas at 2d. per 1000 cubic feet, was approximately £4 10s. per year, running continuously, and taking the consumption of gas as 75 cubic feet per brake-horse-power per hour. Electricity at 1d. per unit cost £28 per brake-horse-power per year.

Mr. PRITCHARD: There are other things you have to compare. First, there is the price of your gas engine or motor?

Witness: Yes. We recently had occasion to put down in our works either a gas-driven or an electrically-driven piece of apparatus. We got estimates from good firms; and we found it to our advantage to put down gas-driven plant, although in an electric lighting station. It is cheaper. We find also that our repairs to the gas-driven part of our machinery is a small fraction of the repairs to our electric machinery. Oil and waste are undoubtedly in favour of the electric motor; but the total amount is so small that, even if the difference is 50 per cent., it is trifling.

Labour and attendance would be a great deal higher with the gas-engine than with the electric motor?—As a matter of fact, it has made no difference whatever in our case. We have got the labour (a small amount) there.

By Mr. PEMBROKE STEPHENS: The Company had about 10,000 lamps spread over 16½ miles of mains. There was about 320-horse power in the works.

Mr. STATHAM: You are in a position, if people were only wise enough to appreciate the benefit, to supply them with power cheaper than they get it from their gas-engines?

Witness: Coal gas in Northwich is very dear and poor, and supplied under low pressure, owing to local causes.

But you are in a position to supply power better and cheaper than they get it?—Certainly.

Yet you find, so conservative or slow going are they in making improvements, that they will not abandon their plant?—No; I do not say so. We are supplying a very fair number of motors in the town. The difficulty is to induce a man who has a very limited amount of capital and a small engine—we have no large manufacturers, except Messrs. Brunner, Mond, and Co.—to abandon the engine.

Mr. *George Hatton*, Managing-Director of the Earl of Dudley's iron and steel works, said that, though he had not had any practical experience of Mond gas, he had seen it used at Winnington in the manufacture of steel in the experimental furnace erected there. The result of his investigation was that he considered Mond gas was an ideal gas for manufacturing purposes. He certainly contemplated using it.

Mr. *Edmund Howl*, General Manager and Engineer of the South Staffordshire Mines Drainage Commission, said he had been actively engaged in the promotion of the present Bill. He described at length the operations of the Drainage Commission, and their needs in the way of power, and stated that he had approached the Midland Electric Company, who had offered to supply them with energy at 1d. per Board of Trade unit, which worked out to £27 per horse power per annum. Mond gas would be very suitable for pumping operations in the district of Bilston, Wednesbury, Willenhall, Darlaston, and Wolverhampton, which could not at present be attacked without permanent plant, which was out of the question. If the mines there were to be drained, and the coal won, some semi-portable power must be employed. That was the reason why the Commissioners had been waiting for several years for some means to attack the district, in which there were 213 collieries. There were many industries in the district which doubtless would be assisted by Mond gas. He estimated that there were 2300 works using heat and power. It was in consequence of a visit that he made to Dr. Mond's works, and there seeing the suitability of Mond gas for supplying power to the district, that the present Bill was promoted.

Cross-examined by Mr. PEMBROKE STEPHENS: The difficulties of distributing and the cost of Mond plant were too great for the Commission to supply themselves with Mond gas. When he got into communication with Dr. Mond, he (witness) suggested the district of South Staffordshire; and then it was inspected by Dr. Mond's staff, to see whether it was suitable for the operations of a company like the present. The fact that the mines in which he was largely interested lay underneath, had a good deal to do with his suggesting the South Staffordshire district.

By Lord R. CECIL: The Commissioners were going to take electricity, which was semi-portable. If they could get electricity at a sufficiently cheap price, it would do for their deep pumping. If they had to pay 1d. per unit, that would be no good whatever. The total power the Commissioners required would be over 1000 pump-horse-power. The Company were not taking authority to lay mains along canals, where the works to be supplied largely existed. But he denied that they were proposing to use the public roads because they would have to pay nothing, whereas if they used the canals they would have to pay for the necessary wayleaves.

Mr. MOON put it to witness that in the Bill there was an agreement between Dr. Mond and the Company, which was conditional on the Bill passing into law in the session of 1901 or 1902, on the Company being incorporated by Act of Parliament, and on at least 22,500 shares being subscribed for by responsible persons. Unless these conditions were complied with before June 30, 1903, either of the parties might annul the agreement. Counsel submitted that if the agreement was annulled the Bill would become useless.

Witness replied that he was not a lawyer.

Mr. MOON: If the agreement with Dr. Mond is put an end to, you cannot supply Mond gas?

Witness: We can supply other gas.

Mr. MOON: The whole evidence has gone on the question whether Mond gas should be supplied or not. If Mond gas is not furnished, you cannot supply at the price suggested.

Mr. WALLACE: But supposing Dr. Mond refused to go on with this agreement, and there was a Bill, the Company could get a compulsory licence under Act of Parliament.

Mr. MOON: Anyhow you are not promoting a Bill to supply any but Mond gas?

Witness: We are promoting a Bill to supply any producer gas.

Do you see that the effect of this provision in the agreement is that, if the Bill passes and these 22,500 shares (which means £225,000) are not subscribed, it is at Dr. Mond's option whether the scheme shall be put an end to or not?—That seems right.

Have you ever heard of Parliament passing a Bill which leaves it at the option of a private individual in his discretion in a certain event to terminate the scheme involved?—I do not follow that it is in the discretion of Dr. Mond. If the Company provide the capital, the thing must go on. I have had no experience of Acts of Parliament.

By Mr. YOUNG: He had satisfied himself that this gas was peculiarly adaptable for gas-engines; that gas-engines could be used for pumping in mines; and that Mond gas in gas-engines was a very convenient fuel. The Mines Drainage Commissioners gave their support to the Bill; but he would not say the measure would not have been promoted but for them.

Mr. YOUNG: You wanted to get your own pumping done, and then you tried to get a district to attract the public money. Is not that the way the thing worked out?

Witness: No; the public money was already attracted.

By Mr. RAM: If the Bill passed, the Company would be able to use any gas they desired, though all the evidence had related to Mond gas. A Company of this magnitude should not be tied to one gas.

By Mr. LLOYD: The object of the Bill was not to float the Mond patents, which had been unable to make headway against the other producer gases. He did not regard the handing over to the proprietors of Mond gas of a large monopoly, in the light of a great assistance to them.

Mr. LLOYD: If you are going to do such enormous good, why do you not extend to Birmingham?

Witness: We may get an invitation from Birmingham later on.

Re-examined: He had no doubt the scheme would go through. He did not think the question of using any other producer gas than the Mond would arise at present. Should a better one be found, he should not like the Company to be debarred from supplying it.

This closed the case for the promoters.

HOUSE OF COMMONS COMMITTEE.

Tuesday, April 30.

(*Before Mr.* F. W. FISON, *Chairman, Mr.* YOXALL, *Sir* A. AGNEW, *and Mr.* RIGG.)

ALDERSHOT GAS AND WATER BILL.

This was a Bill to confirm an agreement for the sale to the Aldershot Gas and Water Company of the undertaking of the York Town and Blackwater Gas and Coke Company, Limited; to extend the limits of supply; and to empower the Company to take land for the storage of gas, and to raise additional capital.

Mr. CLAUDE BAGGALLAY, K.C., and Mr. HUTCHINSON appeared for the promoters; the Hon. J. D. FITZGERALD, K.C., and Mr. G. J. TALBOT represented the Aldershot Urban District Council, the only opponents of the measure. Mr. HARPUR appeared for the York Town and Blackwater Gas and Coke Company, who petitioned against any alteration of the Bill.

Mr. BAGGALLAY, in opening the case, said that before 1866 the district was supplied by two limited Companies—one the Aldershot Gas and Water Company, the other the Aldershot Gas Consumers' Company. In 1866, an Act was passed which incorporated the Gas and Water Company, and authorized the new Company to acquire the Gas Consumers' Company and construct gas and water works. Their limits were coterminous with the parish of Aldershot. In 1887, the Company obtained a Provisional Order which conferred additional capital powers; and in 1890, another Provisional Order was passed, which enabled the Company to raise further capital. Under this Order, it was provided that the new capital should be raised under the auction clauses; and the sliding-scale was applied to the capital of the Company, the standard dividend being 10 per cent. on the capital of 1866, and 7 per cent. on the remainder. The standard price was fixed at 3s. 8d. per 1000 cubic feet, with a scale of 3s. variation in the dividend acting inversely to the variation of 1d. in the price of gas. In 1896, another Act was obtained by the Company, which extended their water limits to include part of the parish of Seale, which was north of the Hogsback. By the same Act, the Company acquired by agreement the North Camp and Farnborough Gas Company, whose area of supply included the parish of Farnborough, the parish of Ash, the chapelry of Frimley, and part of York Town and Camberley; and they obtained power to construct a tramway from Tongham Station, on the London and South-Western Railway, to their gas-works. The Aldershot Urban District Council opposed the Company's Bill; but clauses were agreed by which the Company gave the District Council the right to use the tramway, and the power to purchase the undertaking. At the same time, the water charges were revised and lowered. The capital of the Company was originally, in 1866, £25,000; but by subsequent Provisional Orders this had been largely increased. At present, the total capital raised was: Ordinary shares, £36,500; preference shares, £73,810; premiums, £16,872; and loan, £22,254. This roughly approached £150,000, leaving to be raised £7317 of share and £10,196 of loan capital. The York Town and Blackwater Gas and Coke Company, Limited, which the promoters proposed to acquire, was formed under Provisional Orders of 1890 and 1899; and in part of their area, the promoters had also, by their Act of 1896, powers of supply. There were thus within this area two competing Companies; and negotiations had resulted in the sale to the promoters of the York Town and Blackwater undertaking for the sum of £16,000. The scheme of the promoters was to supply the whole area from the Ash Road works, which would be better and more economical than using a number of different works. They therefore proposed to abandon the manufacture of gas at York Town, and to retain the works for the purpose of storing gas for the northern part of their district. The learned Counsel having dealt with the extension of the limits of supply, said the next point was the regulation of the price of gas. In Aldershot, the standard price was 3s. 8d. per 1000 cubic feet, while the actual charge was 3s.; in the North Camp area, the maximum price was 7s. per 1000 cubic feet, and the actual charge 4s.; while in the York Town Company's district, the standard price was 4s. 9d., and the charge 4s. The Company felt they could not, with justice, make a uniform charge in all districts; and they proposed in

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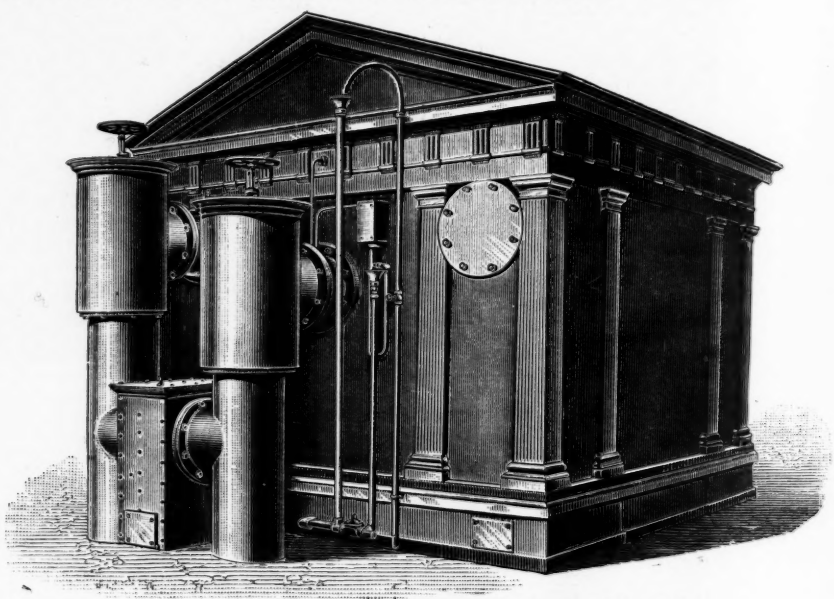

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the Bill to make a higher charge in the districts outside the Aldershot Urban District Council area—the difference not exceeding the 1s. at present existing. The only other proposals of the Bill were to enable the Company to utilize some surplus land, to acquire additional lands for the storage of gas, and to raise further capital of £150,000—£120,000 share, and £30,000 loan. This additional amount they estimated would carry on the Company (having regard to both the gas and water undertakings) for a period of five or six years. Counsel then read, and commented on, the petition of the District Council, which officially alleged that the interests of the consumers would be prejudiced by the additional powers sought by the promoters, and that the pressure of the gas supplied was insufficient and the illuminating power defective. They also contended that the capital of the Company should be properly divided between the gas and water undertakings.

Evidence was then called on behalf of the promoters.

Mr. *A. F. Wilson*, examined by Mr. HUTCHINSON, said he was Chairman of the Aldershot Gas and Water Company, and had taken a responsible part in the management since 1874. Witness detailed the history of the Company as described in the address of Counsel.

In cross-examination by Mr. TALBOT, witness admitted that the Company were taking power almost to double their capital. The gas-works were supplying 710,000 cubic feet per day, and they were in some respects capable of supplying more; but the retort-house was worked to its full capacity.

Mr. TALBOT pointed out that, according to the balance-sheet of the York Town Company, prepared as stipulated by Act of Parliament, the promoters were paying for the Company 62 years' purchase, and giving £16,000 for a concern whose whole capital was only £6915.

Witness replied that the matter was put into the hands of Mr. Corbet Woodall, as a neutral party, to decide the amount they should pay.

Mr. *Corbet Woodall*, examined by Mr. HUTCHINSON, said his firm were Consulting Engineers to the Aldershot Gas and Water Company. He was acquainted with the agreement for purchasing the undertaking of the York Town Company. He was absent from England in September and October, when his firm were requested to advise the Aldershot Company as to the fair value of the York Town undertaking. Judging by the accounts and the information obtained from a visit to the works, the Company were advised that the value was £10,700. Upon this, a communication was received by the Aldershot Directors from the York Town Company that the balance-sheet of 1899 did not fairly and accurately represent the profits earned by the Company in that year, as several items had been charged to revenue which were fairly chargeable to capital. The net result of an adjustment of the accounts was that £477 was found to be the correct profit. This was multiplied by 28½ years' purchase; and 10 per cent. was added to bring the revenue of 1899 up to what they might fairly assume it would be in 1900. He had no hesitation in saying that, while the price was a good one to the shareholders of the York Town Company, it was also altogether a wise purchase on the part of the Aldershot Company. The demands for gas were already largely increasing; and with a reduced price and a better supply, the demand would increase still more rapidly. The cost of making gas at Aldershot would be about one-half what it was at York Town; and the increased business would ensue to the advantage of Aldershot. In the York Town district, the quantity of gas sold to private consumers was, in 1894, 5½ million cubic feet; while in 1899, it had grown to over 10 millions. The undertaking had therefore a very large prospective value; and there was the further advantage that the district of Aldershot went north of the district of York Town; and they would be obliged either to go through it or round it, which would be both costly and troublesome. With regard to the extension of the limits of supply, he considered this extension desirable, because these districts could only be supplied, so far as he could see, by the Aldershot Company.

Wednesday, May 1.

Mr. *Corbet Woodall*, further examined by Mr. BAGGALLAY, said it was a very common thing to authorize a company to charge a higher price in areas outside the main district. In the central districts, the cost of distributing apparatus, of collection, inspection, and so on, was much less than in country areas where the consumers were widely scattered. He knew the outside districts were paying an additional price of 1s. per 1000 cubic feet now; but he thought as the Aldershot Company would manufacture gas much more cheaply than the York Town Company, the difference should not remain at 1s. He was satisfied with the land proposed for storing gas; but, if he had been consulted, he would have advised the creation of twice as much capital as was asked for in the Bill. At the present rate of increase, the sale of gas would be doubled in less than five years; and at £600 per million cubic feet they would expend £92,400 in this period. In his view, allowing £40,000 for the water-works, the Company would be again before Parliament in five or six years.

In cross-examination by Mr. TALBOT, witness said he admitted the price of gas was lower by reason of the combination of the gas and water supply; but he could not agree that this was due to the water being charged at a somewhat high rate. Witness was further cross-examined at length as to the purchase of the York Town Company.

The CHAIRMAN: The pressure at times runs up to 7 inches, and does not seem at any period to be less than 4½ inches. That is very excessive, is it not?

Witness: Yes.

What is the proper pressure for a service-main?—About 2 inches.

What is the proper pressure at which to supply gas to the consumer?—About 2 inches at the meter.

Is that not a little excessive?—No.

If you wish to burn gas in the most economical way, you would like a regulator delivering about 1 inch?—At the burner; but we have to arrange our service-mains so as to provide for the fact that the fittings in the houses are very bad.

Replying to the COMMITTEE, witness said he did not consider the price paid for the York Town undertaking exceptionally high. The purchase was good for all parties concerned.

Mr. *E. B. Taylor*, a member of the firm of Messrs. John Taylor, Sons, and Co., said he was Consulting Engineer to the Company. The present water-works consisted of two pumping-stations, the combined power being 3,000,000 gallons in 24 hours. The maximum demand for Aldershot had been 1,400,000 gallons; and this only occurred on one occasion last summer. The arrangements for pumping were efficient; but the demand was increasing year by year, and the works were beginning to be outgrown. The pumping was absolutely continuous. The pressure was ample; and the rates were very favourable. The water had a hardness of 16·8 degrees on Clark's scale—8·2 degrees of temporary hardness, and 8·6 degrees of permanent hardness. If Clark's process were perfectly worked, about 4 degrees of the temporary hardness would be removed; but the entire system of pumping would have to be rearranged, and the game was not worth the candle. The Company's works during the next ten or twelve years would require a capital expenditure of £40,000.

Mr. *R. W. Edwards*, the Secretary of the Aldershot Gas and Water Company, and Mr. *David Sparvell*, a Director of the York Town Gas Company, having proved the consent of the Companies to the agreement for the purchase, the case for the promoters was closed.

The following evidence was then called for the District Council.

Mr. *E. H. Stevenson* said he had examined the works of the Aldershot Gas Company. They were of ample size for the district. The maximum make was 710,000 cubic feet; but the works at Ash Road were quite capable of manufacturing 940,000 cubic feet per day. With the exception of the purifiers, the plant was largely in excess of the existing requirements. In addition to these works, the Company had works at Farnborough, which had not been used for some time. There was no need for the Company to apply to Parliament, as they had an unexpended capital of £17,500. Passing to the transfer of the York Town undertaking, witness expressed his opinion that the considerable element of value was the right of supplying the district. As a general rule, this right of supply meant three-fifths of the value paid. The right of supply—practically as to nine-tenths of the district—was already possessed by the Aldershot Company; so that the Company were neither getting the right to supply nor works which would be of any value to them. In his opinion, it was a very improvident purchase. If the accounts of the York Town Company were correctly kept, a proper amount was expended on the works, and a reduction in the price of gas taken into consideration, he believed nearly the whole profit would disappear. Turning to the supply of gas, he found there was an excessive pressure—absolutely unknown in his experience. The cause of this was stated by the Manager to be that their mains in the old part of the town were small; and as the gas had to be sent to long distances beyond, they had to give a high pressure at the start. The result to the consumer would be that he would consume twice as much gas, and get no advantage from it. Witness considered the capital powers sought in the Bill unnecessary. As to the accounts of the Company, he thought it very desirable that the accounts of the gas-works and water-works should be kept entirely separate.

In cross-examination, witness said Parliament had in many cases permitted opposition. He disputed any necessity for the purchase of the undertaking; and it was certainly not necessary for the Company to come to Parliament for fresh capital, when they had £17,500 unexpended.

Mr. J. D. FITZGERALD said he had a number of witnesses from Aldershot, who felt very strongly on the Bill; but he would not call them. They objected to the Bill altogether, on the ground that it was a wasteful and extravagant expense, which would be prejudicial alike to the Company and to them. Then there were the questions of pressure and of accounts. The main point, however, was the question of purchase; and he contended this purchase ought not, under the circumstances, to be sanctioned.

It was intimated that the Committee did not think it necessary to hear Mr. Baggallay; and after a short consultation,

The CHAIRMAN said: The Committee have passed the preamble of the Bill; but as to one or two points which have been raised, they wish to make this announcement. With regard, first of all, to the differential clause (No. 8) in the Bill, they consider that there should not be a hard and fast 1s., but that there should be a difference made—that the maximum should be 1s., and the minimum 6d. As to the capital, they agree to the amount in the Bill. Then as to the pressure, they consider that, within a certain time, the pressure in the mains should be reduced to a normal pressure; and they expect some clause to be inserted, or some undertaking given which must be put in the Bill, to that effect. They do not press the separation of the accounts.

Thursday, May 2.

The promoters this morning brought up clauses to carry out the decision of the Committee, and the Bill, having been gone through, was ordered to be reported to the House for third reading.

SOUTH ESSEX WATER BILL.

Last Wednesday, a Select Committee of the House of Lords, presided over by Lord RIBBLESDALE, had under consideration the Bill promoted by the South Essex Water Company to obtain power to construct additional works and extend their limits of supply.

Mr. BALFOUR BROWNE, K.C., who appeared for the promoters, explained that the Company was incorporated by Act of Parliament in 1861 to supply a large district in Essex, including Grays, Purfleet, Barking, Romford, and East Ham. The district was a rapidly-growing one; the population increasing at a great rate, especially in the portion abutting on West Ham. In 1899, the Company came to Parliament with a scheme to supplement their water supply; and the Bill then promoted contained a proposal for an extension of their area to a very large district to the west. They wished to take in 24 new parishes, and to construct, among others, a pumping-station at Mucking, with an aqueduct to a reservoir at Laindon Hills. The period for the completion of the works was fixed at five years. That Bill was lost owing to the opposition of the Local Authorities. Essex was an exceedingly difficult place to supply with water, because there was a tendency, as

was the case at the Company's pumping-station at Grays, where a well was over-pumped, to draw in water from the Thames. In 1899, complaints were made of the Grays water, and also that the proposed new well at Mucking would be liable to a similar drawback. At the same time the Local Authorities told Parliament that they were anxious to acquire the Company's undertaking; and, on their pledging themselves to come to Parliament with a Bill for the purpose, the Company's Bill of 1899 was rejected. In 1900, the Local Authorities came with a very ambitious purchase scheme, asked for a large extension of the area of supply, and proposed to sink seven new wells—the whole scheme involving an expenditure of upwards of £1,000,000. The Company also came with a Bill; but both measures were rejected by a Committee of their Lordships' House—the Local Authorities' scheme principally on the ground of finance, and a dislike to allowing the water to be drawn from beyond their area. The Company, therefore, were still in the same position of not being able to supply their district properly; and they now came with a moderate scheme to make two new wells in the west of their district—one at Seven Kings and the other near Wanstead, where there was every likelihood of good water being obtained. The only expansion of limits applied for was in the north, where they had been asked to supply Havering. Four of the eight Local Authorities who promoted the Bill of last year were contented with the proposals of the Company; and he hoped to be able to satisfy the other four.

At this point a consultation took place with Mr. WEDDERBURN, who appeared for the opposing Local Authorities. At its conclusion,

Mr. BALFOUR BROWNE said a settlement had been reached on the two points outstanding. The pumping at Grays was apt to bring in river water, and to prevent this the Company were to be limited to pumping a reasonable amount of water from that well; and the Local Government Board, in case of disagreement, were to be empowered to decide as to what was a "reasonable amount."

Mr. WEDDERBURN said that if the Local Authorities had obtained their Act, they would have given up Grays on the completion of a new well; and he proposed that the Company should do the same.

The CHAIRMAN: The Committee think that is fair.

Mr. BALFOUR BROWNE said the water at Grays was very hard, and the Company proposed, by the use of Clark's process, to soften it at the end of seven years. This would be an expensive matter; and so the Local Authorities had agreed to that arrangement.

After hearing the case on behalf of the West Ham Corporation, the Committee passed the preamble of the Bill.

Cromer District Council and the Water-Works.—At a recent meeting of owners and ratepayers of Cromer, authority was given to the Urban District Council to purchase the undertaking of the Cromer Water Company, and to take steps for the insertion, in the Company's Bill now in Parliament, of a clause to carry the transfer into effect.

The Dissatisfied Gas-Workers at Carlisle.—Last Wednesday evening a meeting of citizens was held in the Town Hall, Carlisle, to protest against the action of the Gas Committee in refusing to receive Mr. Lynas as the representative of the employees at the gas-works in their application for better conditions of employment. A resolution was passed expressing the hope that the Council would, at their next meeting, instruct the Gas Committee to reopen negotiations with him; and a copy of it was sent to the Mayor.

Sewer Gas Explosion in Manchester.—The operations carried on at the works in the neighbourhood of Bradford Road, Manchester, include tar distilling, the manufacture of sulphuric acid and sulphate of ammonia, benzol rectifying, the manufacture of paint and varnish, the treatment of gas residual products, tar and oil distilling, and similar manufactures. The residents have from time to time made complaints of nuisance. It is stated that sulphuretted hydrogen has been found to be given off in the sewers. At all events, noxious vapours find their way into them; and last Friday afternoon an explosion occurred which blew up the ironwork of a manhole, with the heavy stone setts surrounding it. This was quickly followed by a similar explosion at the next manhole, and others at the succeeding ones covering a distance of nearly 400 yards. The reports were accompanied by flame. Fortunately no personal injury was sustained.

Abertillery Water Supply.—Mr. W. A. Ducat, one of the Inspectors of the Local Government Board, recently held an inquiry at the offices of the Abertillery District Council in regard to an application by the Council for authority to borrow an additional £4500 for the purposes of the water undertaking at Cwmtillery. The Clerk (Mr. J. A. Shepard) stated that the population, according to the recent census returns, was 21,900, compared with 11,094 in 1891. The assessable value of the district was £82,000, and the outstanding loans were as follows: Contracted under the Sanitary Acts, £18,258; under the Abertillery Gas and Water Act, £17,415 for gas and £50,012 for water. Mr. Togarmah Rees, of Newport, stated that the new water-works consisted of a reservoir designed to hold 50 million gallons. The contract for these works was let in July, 1895, and should have been completed at the expiration of two years. But in consequence of the great and unforeseen difficulties encountered in excavating the trench for the puddle wall, the period had been from time to time extended; and even now it was considered necessary, in order to make the reservoir perfectly water-tight, to extend the trench. The original contract sum was £15,623; but in consequence of the difficulties stated, this amount had been greatly increased, and £22,597 12s. 6d. had already been paid. It had also been found necessary, in order that the water stored in the reservoir might be fit for human consumption, to remove from its bed peat and vegetable matter. The floor of the service-tank should also be laid with concrete to make it water-tight. The whole of this additional work he estimated at a little over £4000. It was found necessary to excavate the puddle trench in one instance to an additional depth of 40 feet. In this depth—and, in fact, for nearly the whole of the trench—the most difficult ground, consisting of huge boulders, was encountered, and no sound ground was found on the western side of the valley until the trench had been extended for a considerable distance beyond what was at first anticipated—thus greatly delaying the completion of the work and increasing the cost. In reply to the Inspector, Mr. Rees said there had been several leakages. There was no opposition.

MISCELLANEOUS NEWS.

THE EXAMINATIONS IN GAS MANUFACTURE.

The Question Papers Set at the City and Guilds of London Institute Examinations.

The examinations in "Gas Manufacture" conducted by the City and Guilds of London Institute were held last Wednesday. The following were the questions set by the Examiner (Dr. Harold G. Colman):—

ORDINARY GRADE.

1. Describe the changes which take place when coal is carbonized in a closed retort. 2. Explain, with the aid of sketches, the construction of one form of atmospheric condenser, showing the means by which the condensed products are removed. 3. Give an account of the manner in which ammonia is removed from crude coal gas, and state the precautions necessary to ensure its complete elimination. 4. How are the joints made in the cast-iron pipes used for the distribution of gas? 5. Describe the construction and method of working of a works governor for controlling the pressure of gas supplied to the district. 6. Explain the principles on which the determination of illuminating power depends. 7. Explain the construction of the incandescent burner, and state any precautions you know which should be taken in fitting it up to ensure obtaining good results. 8. Give an account of the treatment to which lime and oxide of iron must be subjected before they are ready for use in the purifiers. 9. How would you determine the percentage of moisture and sulphur in a sample of spent oxide? 10. Explain the construction of the dry meter.

HONOURS GRADE

1. Explain the principles on which the system of gaseous firing depends, and describe fully the method of managing a generator furnace so as to obtain effective heating of the retorts with a low consumption of fuel. 2. Discuss the effect of the rate of cooling of the hot gas issuing from the hydraulic main on its subsequent illuminating power. 3. A new works is being erected, having a maximum producing capacity of a million cubic feet per diem. State what apparatus you would recommend for the complete removal of ammonia from the gas after condensation, together with as much carbonic acid and sulphuretted hydrogen as possible. Give the reasons on which your selection is based. 4. Give sketches showing the construction of a dry purifier, and of the necessary connections for working four such purifiers in a set. 5. Explain, with the aid of sketches, the construction of a suitable guide-framing for a two-lift gasholder, about 150 feet in diameter and 60 feet in height, and of the cup and grip of the inner and outer lifts respectively. 6. State what you know of the question of naphthalene stoppages, and describe any one method which has been adopted on a large scale, with the view of overcoming the difficulty. 7. Under what circumstances are district governors employed, and in what manner does their action differ from that of the works governor? 8. Describe the following standards of light: (*a*) Sperm candles, (*b*) the Methven screen, (*c*) the Harcourt 10-candle pentane lamp. Give some account of the relative advantages and disadvantages. 9. Sketch the construction of a continuous still for the distillation of ammoniacal liquor, and explain the method of working adopted. 10. Give an account of the chief constituents of coal gas, and state in general terms the effect of each on the illuminating power of the mixture.

In the Ordinary Grade, 40 marks were allowed for Nos. 1, 2, 5, 7, and 10; 35 for Nos. 6 and 8; and 30 for Nos. 3, 4, and 9. In the Honours Grade, 40 marks were allowed for Nos. 1, 3, 5, 6, and 8; 35 for Nos. 4 and 9; and 30 for Nos. 2, 7, and 10. Four hours were allowed for each paper; and not more than eight questions were to be attempted.

MANCHESTER CORPORATION GAS SUPPLY.

The Estimates.

At the Meeting of the Manchester City Council, held on Wednesday last, the estimates of the various Committees for the year ending March 31, 1902, were brought up for approval.

Alderman GIBSON, in submitting the Gas Committee's statement, of which a summary has already been given in these columns (*ante*, p. 1073), remarked that he had no special observations to make with regard to it, but would be glad to answer any questions which might be put to him by members of the Council.

Mr. F. BROCKLEHURST said he would ask the Council to reject the estimates of the Gas Committee, and send them back for further consideration. He was not competent to criticize the details, and would not attempt to do so. It seemed, however, extraordinary that, with the price of coal falling, the Committee should estimate an expenditure of £340,000 on coal, cannel, and oil, as against only £319,000 last year—representing an increase of about £21,000. He noticed that they were to have this year £11,172, as against £52,500 last year, in relief of the rates—a difference of over £40,000. He wanted to ask how it was, if the Gas Committee had to pay £21,000 more for coal, that they were not going to ask the consumers to pay a reasonable proportion of the increase.

Mr. BATTY doubted whether this was the proper time to raise the question of an increase in the price of gas. He thought it might more properly be brought forward at their next meeting, in June

Mr. BROCKLEHURST observed that he was only stating a general principle. He was not going to propose a resolution as to the price of gas.

The DEPUTY TOWN CLERK remarked that, if the precedent of last year were adopted, the course to follow would be to amend the estimate at the present meeting, by increasing the amount which the Committee proposed to hand over to the city fund; and this would impose upon

the Committee the duty—which could be mentioned in the resolution—of so re-arranging their charges as to virtually involve an increase in the price of gas; and this would come before the Council at their next meeting. He did not think it would be regular, at the present meeting, to increase the price of gas, as notice had not been given.

Mr. BROCKLEHURST did not altogether agree with the policy which had been depicted by the Deputy Town Clerk, of instructing a Committee upon a definite line of action. He would prefer that the matter should be referred back to them; and they could then bring forward an amended scheme upon the general, and not the specific, instruction of the Council. He would, however, be prepared to move an amendment which would permit the Committee to take a course that would bring them in accord with any resolution determined upon by the Council. He was not going to propose that the price of gas should be increased. If the Gas Committee had to pay more for coal, it was reasonable to expect consumers of the product of the coal to be called upon to pay a little more for their gas. He did not, however, want to suggest this as a policy for the Committee. He believed, on the whole, there was great public advantage in cheap gas. He wanted to recommend an alternative proposal. They were asked that day to increase the rates by 4½d. in the pound, bringing the total to 6s. 5½d. This was a very considerable amount; and he thought it was within the scope of their duty, as representatives of the public, to bring down the general rating of the city to as low a point as possible. If they could reduce the rating by 3d. in the pound, and if that was possible without increasing the price of gas, or without any permanent disadvantage to the public, it was, in his opinion, their duty to adopt this course; and he was going to suggest it to the Council. He found, on looking into the figures of the Gas Department, that in 1894 they transferred to the city fund in aid of the rates £64,321. They might remember that recently Alderman Gibson agreed that £50,000 was a reasonable amount to expect the Committee to pay in aid of the rates.

Alderman GIBSON: I said nothing of the kind. What I said was that a large concern like the Manchester gas undertaking ought to realize a profit of £50,000 a year.

Mr. BROCKLEHURST: I am obliged to Alderman Gibson for supporting my statement.

Alderman GIBSON: It is quite a different thing.

Mr. BROCKLEHURST (continuing) observed that in 1894 £64,321 was handed over. Of this, £30,590 came out of profits, and £33,731 was drawn from the contingent fund of the Committee. He knew Alderman Gibson would tell them that the contingent fund was already low enough. He admitted, candidly, that in view of the enormous liabilities of the city, the contingent fund was not sufficient for its purpose. At March 31 last year, it stood at £66,164; and he thought this figure should be naturally increased. It was certainly not too high in view of the enormous liabilities of the city—the requisite provision in the event of explosions, &c. It was advisable that they should have a large contingent fund; but they were face to face with very exceptional circumstances, and such circumstances demanded exceptional procedure. He was therefore going to advise that the contingent fund should be drawn upon for the relief of the rates to the extent of £40,000. He had a strong case to present. In 1894, the contingent fund only amounted to £39,612; and because of the needs of that year, this was reduced to a balance of £5880. In consequence of the peculiar needs of the time, the Gas Committee voluntarily handed over £33,731 from the contingent fund, although in so doing they knew that they would bring the fund down to less than £6000. The rates of the city at that time were only 4s. 6½d. To-day the proposition was to make a rate of nearly 2s. above that amount. They could fairly claim that the circumstances were exceptional. If they withdrew £40,000 from the contingent fund, £26,164 would be left. That was to say, while relieving the rates by 3d. in the pound, they would leave the contingent fund nearly five times larger than in 1894.

Alderman GIBSON: We have not got £40,000 in the contingent fund. There is only £30,000.

Mr. BROCKLEHURST said he was dealing with the statements of twelve months ago, which were the only ones he had before him. If there was anything like £30,000 in the fund, he thought it was an obvious duty on the part of the Committee to relieve the rates out of it, as they voluntarily did seven years ago. He did not think the Committee had met the exceptional needs of the city in the sympathetic and generous spirit which they ought to have shown. There had been no real attempt to meet the exceptional requirements of the present year. If the contingent fund stood at less than £30,000, he should be inclined to modify any resolution he might propose. He was not desirous of advocating a policy which would unduly raise the price of gas (though if gas consumers were called upon to pay an increase, it would be justified on the grounds of equity). But he had desired, in view of the figures he had before him, to lay the burden on the contingent fund—a burden which it had appeared well able to bear. He thought if the estimates were revised it might be possible to bring up the contribution of the Committee to £51,172, which brought it very near to the sum Alderman Gibson confessed to be a reasonable profit. He begged to move, as an amendment—"That the balance of surplus estimated by the Committee be amended by the addition of £40,000."

Mr. PLUMMER said he would second the proposal, if it were put in the following form—"That the estimates of the profit and loss account of the Gas Committee be amended by the substitution of £50,000 for £11,172 as the surplus profits to be paid to the city fund; and that the Committee be instructed to propose such alterations in their charges as are necessary to effect such amendment."

Mr. BROCKLEHURST agreed to this suggestion.

Mr. PLUMMER explained that he differed from Mr. Brocklehurst as to the contingent fund. As Alderman Gibson had just explained, this had been reduced during the past year to £30,000; and Mr. Brocklehurst, by admitting that £66,000 was little enough, had materially weakened his position in asking them to deal with the contingent fund as a resource under present circumstances. He would like to point out that, so far from their present position being exceptional, as Mr. Brocklehurst had attempted to show, it was rather favourable; and after another year had gone by, they would in all probability, have a still further advance in the estimates of the Council, and an increasing state of distress in the city with regard to employment, and financial pressure generally. They were not dealing with an emergency, but possibly with the commencement of times which for the city would be far worse than those they had been passing through. They were at the end of the period of prosperity; and by the natural course of reaction, they were bound to have a time of adversity. He thought Alderman Gibson ought, in submitting the estimates, to have stated his case, and not to have left them with no opportunity of replying to any arguments he might urge. He based his own case, first of all, on the principles of equity, sanctioned and adopted by the Council when the matter was recently discussed. Alderman Gibson admitted that the ratepayers ought to be "enriched." He himself used the expression "benefited;" but Alderman Gibson drew a subtle distinction—

Alderman GIBSON: I said "enriched," and say it to-day. It is a very different thing from paying £50,000 to the ratepayers.

Mr. PLUMMER (continuing) said that Alderman Gibson admitted that the ratepayers, as such, ought to be enriched by the operations of the Gas Committee, to the extent of £50,000; but so far from being benefited, as ratepayers, by £50,000, they were only going to receive some £11,000 on the basis of the estimates submitted. He found that this reduction arose entirely from the increase in the price of coal. The estimates for last year were £300,000 for coal; those for the current year were £340,000. This increase represented the exact difference at issue. If the cost of production of a commodity had been increased, surely the price charged for it should also be raised; and it was not merely a piece of caprice or for the benefit of the rates, but an absolute duty, to charge to the consumer the extra £40,000 they had to pay for coal. Their plain duty was to advance the price of gas to meet the increased cost of coal.

Mr. EDWARD HOLT expressed the opinion that a Committee having at their disposal a capital of over £2,000,000, should be able to make a reasonable percentage upon the investment; and £11,000 was not at all in accordance with what, in a business concern, they would expect to hand over as profit.

Alderman GIBSON reminded the Council that he had twice brought the gas question before them, and both times his principal opponent had been Mr. Plummer. On the last occasion, he had quite expected Mr. Plummer to come to the Council meeting armed *cap-à-pie* with arguments; but he had come absolutely naked, with the exception of one bow and two barbed arrows. One of those arrows was the reference to *Athanasius contra Mundum*, and the other an allusion to the character of "Presumption" in the "Pilgrim's Progress," with both of which persons, Mr. Plummer remarked, Alderman Gibson might be compared. Those were the two arguments Mr. Plummer offered to the Council; but he had never ventured to question one single statement that he (Alderman Gibson) had made. He had discussed a point that was not before the Council. It was a matter, not of gas profits, but of the allocation of gas profits, that was before them; and neither Mr. Plummer nor any other of the speakers who opposed his (Alderman Gibson's) motion had touched upon that point. As to the present estimates, it was for the Council to say what instructions they wished to give to the Committee; and the Council must take the responsibility. He ventured to say that, if they had been good enough to accept £20,000 last year, without increasing the price of gas, the Committee would have been able to give them £20,000 this year; and it would have been probable that a third year would work the Gas Committee out of their difficulties. In his opinion, the Council last year legislated in a panic. They did an unwise thing in increasing the price of gas. What was the consequence? In 1895, they reduced the price of gas 3d. per 1000 cubic feet. This was apparently not much; but it had a marvellous effect. At that time the daily consumption was 3,683,000 cubic feet. In 1900, the consumption had increased to 4,726,000 cubic feet. In 1895, the gross profit was £134,000. They ought never to have made any such profit. In 1900, it was £149,000. What had happened now? Last year they increased the price of gas 3d. per 1000 cubic feet, which took effect during nine months of the year. During the first three months the consumption of gas showed a normal increase; but in the nine months of the higher price, there was a tremendous decrease, and if they put a further 3d. on the price, he was sure there would be another very considerable decrease. He was desirous of applying the rules which he had found successful in his own business career to the business of the Gas Department; and he had never found that his own business was increased by the raising of the price of any article. It was, however, for the Council to say what was to be the policy of the gas undertaking. If they were determined that this £50,000 a year must be given to the ratepayers, to whom it was an injury, and an injustice, as he had shown on a previous occasion, when no one had an answer to give to his arguments, and when he had pointed out that this subsidy was only a relief to the large ratepayers, and a great injustice to the smaller ones—if they were prepared to insist on this being done, it was for themselves and not for him to say. As to Mr. Brocklehurst's remarks, he could assure them that the Committee had gone over the estimates with great care; and if they were to hand over the amount mentioned, they would have no resource but to raise the price of gas, or apply to the contingent fund. They had £30,000 in this fund; and if the Council said they must give this sum in reduction of the rates, it was their business and not his, and theirs would be the responsibility of leaving the gas undertaking without a contingent fund. He had been endeavouring to get the fund to the level reached in Birmingham and elsewhere—certainly not less than £100,000; but something had always happened to prevent the realization of this object. As to what was done in 1894, he was not Chairman at that time, and did not know why the contingent fund was depleted. Perhaps the Committee happened to be in a very generous mood. Athough the fund was to be used for contingencies, it was applicable to contingencies happening in the Gas Department, and not in every part of the city. Mr. Plummer said the reduction in profits was absolutely on account of the increased price of coal; but he (the speaker) differed. As he had already pointed out, if they had accepted £20,000 last year, they could have had £20,000 this year, because the increase in the consumption of gas would have gone on. The Gas Committee had done their best. They had not jumped at any conclusions; and they now left themselves entirely in the hands of the Council.

Mr. GREENHOW thought the amendment a reasonable one. If they

paid more for coal, they must increase the price of gas. Supposing they advanced it to 2s. 9d. per 1000 cubic feet in the city, and 3s. outside, this was not a high price. He did not live in Manchester, and was paying more than that. He did not consider 2s. 9d. a high price; and consumers could afford to pay it until coal came down to a reasonable figure. As to legislating in a panic, he thought an instance of that was when they reduced the difference between the charge to those in and outside the city from 6d. to 3d. They did not want £20,000, they wanted £50,000 profit out of the undertaking; and unless they received it, he did not think they were managing that concern in the interests of the ratepayers. He did not think, however, they should take it from the contingent fund. His point was that when they could not get materials at the same price, they must increase the price of the article.

Mr. BATTY supported the amendment; adding that he intended to take the same line of action in regard to the charges for electricity.

Mr. LAMBERT saw no reason why the Gas Committee should be picked out this year, as last, in order to provide for the increased demands of the other Committees, without increasing the rates. Taking the Watch, Cleansing, Sanitary, Improvements, Technical Instruction, Parks, Paving, Free Libraries, and Town Hall Committees, they found the total increased amount required was £55,176, or equal to a rate of a fraction more than 4d.; so that almost the whole of the proposed addition to the rates was made up by the increased estimates of other Committees than the Gas Committee. And why should the Council seek to meet these increased demands of other Committees by calling upon the Gas Committee to revise their estimates, so as to hand over a sum which, according to estimates that had been carefully considered, they could not see their way to give? The Council practically said that they accepted the estimates of every Committee but the Gas Committee, who were told to devise means of increasing their profit to £50,000, so that the increased demands of the other Committees might be met without raising the rates. It was for the Council to instruct the Committee how to secure the amount. If they thought proper to increase the price of gas, it was in their province to do so; and the Council as a body must take the responsibility. He hoped, however, they would not think of taking the money out of the contingent fund. This had been reduced to £30,000 during the year; and they did not know what contingencies, pertaining to the gas undertaking, they might be called upon to meet at any moment.

Alderman COPELAND remarked that the question of taking the sum from the contingent fund had dropped.

Mr. ROYLE said the amendment did not stipulate how the sum must be raised; it only required that it should be increased to £50,000.

Mr. LAMBERT said that if it was understood that the Council did not instruct or recommend the Committee to raise the amount from the contingent fund, he had nothing more to say, and the Council must take the sole responsibility as to the price of gas.

The amendment was then put to the meeting, and carried by 31 votes to 11. It was then adopted as a substantive motion.

The ordinary minutes of the Gas Committee were adopted without comment.

POTHERHAM CORPORATION GAS UNDERTAKING.

The Past Year's Working.

At the Meeting of the Rotherham Town Council last Wednesday, the Mayor (Mr. G. Gummer), who is Chairman of the Gas Committee, in moving the adoption of the Committee's minutes, made a long statement as to the operations of the department during the past year to which reference was made last week.

He said the public might have the idea that the works had not been so successful as in previous years. From a manufacturing standpoint, the officials were to be complimented upon the manner in which the accounts had come out. During the past year they had been receiving part of the benefits of the extensions and the vast amount of money spent upon them; and while the consumption of gas had been lower than was anticipated, owing to the mild winter, and also to the absence of fogs, there had been a slight increase in the make of gas, which had been 268,636,000 cubic feet, against 256,712,000 cubic feet in the previous year, or a rise of 11,924,000 cubic feet—practically 4½ per cent. It was satisfactory to know that, owing to the new plant, the coal carbonized was less. The make of gas per ton of coal was 11,704 cubic feet, against 10,322 cubic feet. The consumption had been 238,688,000 cubic feet, against 231,646,000 cubic feet, or an increase of 3 per cent. The difference between the make and the consumption was accounted for by increased leakage resulting from subsidences. The augmented consumption had, as in the past, been attributable almost solely to the automatic meters, which showed an increase of 12½ per cent., against 1 per cent. for the ordinary meters. The ordinary consumers numbered 10,758, as compared with 9995, or an increase of 763. There had been 696 new automatic meters fixed during the year; making the total 6416, against 4342 ordinary meters. Turning to financial matters, coal had cost £18,123, against £13,702 last year, or an increase of £4421; the average price per ton being 14s. 11½d., against 11s. before. In the two years the department had paid no less than £7508 more for coal alone. Adding this to the extra burden they had to bear upon capital, and the alterations that had come out of revenue, it would be seen that the department had done fairly well, considering the manner in which it had been handicapped. They had an increased revenue from gas of £2200, and from residuals of £1700. The gross profit for the year was £9744, against £11,545, or a decrease of £1801. Taking the additional revenue derived from the price of gas and residuals, and setting these amounts against the rise in the price of coal, there was left £1539, to which had to be added £1137 for alterations; the sum remaining being £2676, which they had to meet. Seeing that they still showed a small profit, he thought the Council must admit that the department had come out very well. The net profit, after paying dividends on stock and to sinking fund, was £1845, against £4189. Out of this they gave the Highway Committee £2564 for lighting; leaving a deficit on the year of £719.

The minutes were confirmed after a brief discussion.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 1184.

Issue.	Share.	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
590,000	10	Apl. 12	10½	Alliance & Dublin 10 p.c.	19—20	..	5 5 0
100,000	10	,,	7½	Do. 7 p.c.	13—14	..	5 7 2
300,000	100	Jan. 2	5	Australian 5 p.c. Deb.	101—103	..	4 17 1
200,000	5	Nov. 14	6½†	Bombay, Ltd.	6—6¼	..	5 0 0
40,000	5	,,	6½†	Do. New, £4 paid	4¼—4⅝	..	5 9 5
380,000	Stk.	Feb. 14	12	Brentford Consolidated	260—265	..	4 10 7
270,000	,,	,,	9	Do. New	187—192	..	4 13 9
50,000	,,	,,	5	Do. 5 p.c. Pref.	128—132	..	3 15 9
159,375	,,	Dec. 13	4	Do. 4 p.c. Deb.	113—116	..	3 9 0
220,000	Stk.	Mar. 14	10	Brighton & Hove Orig.	222—227	..	4 8 1
226,320	,,	,,	7	Do. A. Ord. Stk.	160—165	..	4 4 10
1,022,500	Stk.	Feb. 27	5	Bristol, 5 p.c. max.	119—121	−2	4 2 8
420,000	20	Mar. 28	10	British	41—42	+½	4 15 3
50,000	10	Feb. 28	12	Bromley, Ord. 10 p.c.	24—26	..	4 12 4
79,000	10	,,	9	Do. 7 p.c.	19—21	..	4 5 8
500,000	10	Oct. 12	6	Buenos Ayres (New) Ltd.	9—10	..	6 0 0
220,000	Stk.	Dec. 28	4	Do. 4 p.c. Deb.	97—100	..	4 0 0
150,000	20	Mar. 14	8½	Cagliari, Ltd.	22—24	..	6 17 6
100,000	10	Sept. 28	8	Cape Town & Dis., Ltd.	14½—15⅝	..	5 3 3
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	51—53⅝	+1	5 13 2
550,000	Stk.	Apl. 12	12	Commercial Old Stock	275—280	..	4 5 9
236,425	,,	,,	9	Do. New do.	205—210	..	4 5 9
238,237	,,	Dec. 13	4½	Do. 4½ p.c. Deb.	130—135	..	3 6 8
800,000	Stk.	Dec. 13	9	Continental Union, Ltd.	165—170	..	5 5 11
200,000	,,	,,	7	Do. 7 p.c. Pref.	163—168	..	4 3 4
575,000	Stk.	Feb. 28	5	Crystal Palace Ord. 5 p.c.	120—125	..	4 0 0
60,000	,,	,,	5	Do. 5 p.c. Pref.	127—132	..	3 14 1
486,090	10	Jan. 31	11	European, Ltd.	20—21	..	5 4 9
354,060	10	,,	11	Do. £7 10s. paid	14½—15½	..	5 6 5
15,079,885	Stk.	Feb. 14	4 4/10	Gas- 4 p.c. Ord.	94—96	..	4 11 8
2,600,000	,,	,,	3½	light 3½ p.c. max.	89—92	..	3 16 1
3,799,735	,,	,,	4	and 4 p.c. Con. Pref.	110—113	..	3 10 10
4,063,425	,,	Dec. 13	3	Coke 3 p.c. Con. Deb.	94—96	..	3 2 6
70,000	10	Oct. 26	8	Hongkong & China, Ltd.	13½—14½	..	5 10 4
3,800,000	Stk.	Nov. 14	10	Imperial Continental	215—220	..	4 10 11
473,600	Stk.	Feb. 14	3½	Do. 3½ p.c. Deb. Red.	100—102	..	3 8 8
561,000	Stk.	Feb. 28	10	Liverpool United A	234—236	..	4 4 9
678,100	,,	,,	7	Do. do. B	170—173	..	4 0 11
306,083	,,	Dec. 28	4	Do. do. Deb. Stk.	120—122	..	3 5 7
75,000	5	Dec. 13	6	Malta & Medn., Ltd.	4⅞—5¼	..	5 14 3
560,000	100	Apl. 1	5	Met. of 5 p.c. Deb.	104—107	..	4 13 5
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	102—104	..	4 6 6
541,920	20	Nov. 14	3½	Monte Video, Ltd.	9½—10⅝	..	6 13 4
717,946	Stk.	Feb. 22	8½	Newc'tle & G'tesh'd Con.	226—227	..	3 14 11
312,855	Stk.	Dec. 28	3½	Do. 3½ p.c. Deb.	101—102	..	3 8 8
150,000	5	Nov. 29	8	Oriental, Ltd.	7—7½	..	5 6 8
135,000	5	,,	8	Do. New, £4 10s. pd.	6—6¼	..	5 10 9
15,000	5	,,	8	Do. do. 1879, £1 pd.	1¼—1⅝	..	4 11 5
					*Ex. div.		

Issue.	Share.	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
60,000	5	Feb. 28	7	Ottoman, Ltd.	5⅜—6⅛	..	5 12 0
851,070	10	Apl. 26	7	River Plate Ord.	10¾—11⅛	..	6 4 5
250,000	Stk.	Dec. 28	4	Do. 4 p.c. Deb.	97—99	..	4 0 10
250,000	10	Mar. 28	8	San Paulo, Ltd.	11—12	..	6 13 4
135,000	Stk.	Mar. 14	10	Sheffield A	235—240	..	4 3 4
209,984	,,	,,	10	Do. B	234—236	..	4 4 9
523,498	,,	,,	10	Do. C	234—236	..	4 4 9
5,761,885	Stk.	Feb. 14	5	South Met., 4 p.c. Ord.	131—134	+1	3 14 8
1,547,965	,,	Jan. 16	3	Do. 3 p.c. Deb.	93—96	..	3 2 6
380,940	Stk.	Nov. 14	5	Southampton Ord.	108—113	..	4 8 6
70,825	,,	Jan. 16	4	Do. 4 p.c. Deb.	105—110	..	3 12 9
120,000	Stk.	Feb. 28	6	Tottenham A. 5 p.c. and B. 3½ p.c.	115—120	+3	5 0 0
250,520	,,	,,	4½		85—90	+1	5 0 0
80,100	,,	Dec. 13	4	Edmonton 4 p.c. Deb.	109—114	..	3 10 2
182,380	10	Jan. 16	5	Tuscan, Ltd.	8—9	..	5 11 1
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.	97—102	..	4 18 0
230,000	5	Feb. 28	9	West Ham, 10 p.c.	9—10	..	4 10 0
147,000	10	,,	6	Do. 7 p.c.	11¾—12½	..	4 16 0
128,984	Stk.	Dec. 28	4	Do. 4 p.c. Deb.	105—110	..	3 12 9
				WATER COMPANIES.			
780,499	Stk.	Dec. 28	11	Chelsea, Ord.	295—300	..	3 13 4
150,000	,,	,,	5	Do. 5 p.c. Pref.	155—160	..	3 2 6
160,000	,,	,,	4½	Do. 4½ p.c. Pref. '75	140—145	..	3 2 1
175,785	,,	Mar. 28	4½	Do. 4½ p.c. Deb.	140—145	..	3 2 1
1,720,560	Stk.	Apl. 12	7	East London, Ord.	188—193	..	3 12 6
654,740	,,	Dec. 13	4½	Do. 4½ p.c. Deb.	145—150	..	3 0 0
797,687	,,	,,	3	Do. 3 p.c. Deb.	95—97	..	3 2 6
700,000	50	Dec. 13	8	Grand 10 p.c. max.	107—110	..	3 12 9
310,000	Stk.	Mar. 28	4	Junction 4 p.c. Deb.	123—127	..	3 3 0
708,000	Stk.	Feb. 14	14	Kent	300—305	..	4 12 5
160,000	,,	,,	7	Do. New, 7 p.c. max.	200—205	..	3 8 4
1,043,800	100	Dec. 28	10½	Lambeth, 10 p.c. max.	270—280	..	3 15 0
406,200	100	,,	8	Do. 7½ p.c. max.	207—212	..	3 15 5
350,000	Stk.	Mar. 28	4	Do. 4 p.c. Deb.	123—126	..	3 3 6
500,000	100	Feb. 14	13⅜	New River, New Shares	407—412	..	3 6 9
1,000,000	Stk.	Jan. 31	4	Do. 4 p.c. Deb.	125—130	..	3 1 7
902,300	Stk.	Dec. 13	7	South-wark Ord.	188—193	..	3 12 6
126,500	100	,,	7	7½ p.c. max.	177—182	..	3 16 11
489,200	Stk.	,,	5	and 5 p.c. Pref.	153—158	..	3 3 3
1,019,585	,,	Apl. 12	4	Vauxhall 4 p.c. A Deb.	125—130	+½	3 1 7
1,155,066	Stk.	Dec. 13	10	West Middlesex.	265—275	..	3 12 9
200,000	,,	,,	4½	Do. 4½ p.c. Deb.	140—145	..	3 2 1
200,000	,,	Mar. 14	3	Do. 3 p.c. Deb.	96—98	..	3 1 3
					*Ex. div.		

† Next dividend will be at this rate.

SOUTHAMPTON GAS COMPANY.

The Half-Yearly General Meeting of this Company was held last Wednesday—Mr. R. C. HANKINSON, J.P., in the chair.

The SECRETARY (Mr. C. Crowther Smith) having read the notice convening the meeting, the report of the Directors was presented. It set forth that, taking the entire year 1900, there had been an increase of 28 million cubic feet in the quantity of gas sold—the maximum yet attained. The consumers on the prepayment meter system numbered 3700, nearly all of whom were using cookers. In addition to these, there were 2100 ordinary cookers on hire, and a very large number of gas heating-stoves in use. The amount available for distribution was £10,244; and the Directors recommended the payment of the maximum dividends, less income-tax. A sum of £719 would have to be drawn from the undivided balance to allow of this being done; and there would be £945 to be carried forward. Additional works were in progress, including a holder to store 2 million cubic feet of gas, a new purifying-house and purifiers, and also three blocks, containing 18 dwellings, for the working classes.

The CHAIRMAN, in moving the adoption of the report, referred to the high price of coal, and to the consequent necessity for raising the charge for gas, in common with other companies. The consumers had, however, been long-suffering, as he had not heard a single complaint. Coal and oil cost, in the half year under notice, £7300 more than in the corresponding period of 1899; and this fact would give the proprietors some idea of the anxious time through which the Directors had passed. As to coal, he was glad to say the Board had lately made a new contract at a very considerable reduction on the price they had been paying. In this they considered they were fortunate, because the price had gone up 9d. a ton since the agreement was entered into. Another thing which told against the Company was the falling off in the value of residuals. This was a matter which the Directors could not control, though the reduction affected the income of the Company very considerably. One favourable feature was the introduction and progress of the prepayment or penny-in-the-slot meter—a system which was very popular; the number of meters issued was increasing every day. Many of the people who had gas in this way also used gas-cookers; and altogether the system had been a most important thing for the Company and for all others who had adopted it. The result was that they had sold more gas in the past half year than during any previous period in the history of the Company. The new works which it had been found necessary to undertake involved the raising of a large amount of capital; but the expenditure must be incurred to meet the demands.

Dr. TREND seconded the motion; and it was carried unanimously.

The maximum dividends were then declared; and the proceedings closed with the customary votes of thanks to the Chairman and Directors, Secretary, Engineer (Mr. S. W. Durkin), and staff.

The salary of Mr. S. Glover, the Gas Engineer of the St. Helens Corporation, has been increased by £100 per annum.

ELECTRIC LIGHTING NOTES.

The Lords Commissioners of the Treasury have given their sanction to the issue of a loan of £22,000 to the Limerick Borough Council, for the purpose of carrying out the scheme for providing electric light for the city. The loan will be issued in four instalments, at 3¼ per cent., and repayable in 25 years.

The electricity works of the Rochdale Corporation are no charge upon the rates this year. There is a deficiency of £1666 15s. 6d.; but, instead of wiping this out at once, the Committee propose to place it to a suspense account till profits accrue. The expenditure in the past year amounted to £2820, including £1990 for interest and sinking fund. The income is £1153, of which £698 comes from the users of current. Bank interest increases that by £436.

The Town Clerk of Canterbury (Mr. H. Fielding) has reported upon the second year's working of the electricity supply undertaking of the Corporation. The number of consumers connected on March 31 last was 259, as compared with 195 on the corresponding date in 1900. The revenue account shows a gross surplus of £1885, against £1913 last year. This is applied as follows: Interest on loan, £882; redemption of capital, £990—leaving a net profit of only £13, as compared with £406 last year.

Readers of the "JOURNAL" are aware that the pretty little town of Shanklin, in the Isle of Wight, has been in a state of agitation for some time on the subject of the public lighting. Opinion has been about equally divided on the relative merits of gas and electricity; but the estimate put forward by the Gas Company commended itself to favourable consideration from the fact that it offered greater lighting power, by the incandescent system, than that proposed by the Electric Light Company, and for £85 per annum less. Why the ratepayers should be asked to bear an additional burden for the sake of introducing a new-comer is not very apparent, but they have shown their willingness to do so. The question was settled by a poll taken on Monday last week, when the numbers were: For electricity, 236; for gas, 216—majority for electricity, 20.

Last Tuesday, Mr. W. O. E. Meade-King, M.Inst.C.E., held an inquiry at the Guildhall, Bury St. Edmunds, in regard to the application made by the Corporation to the Local Government Board for authority to borrow £12,000 for electric lighting purposes, the repayment of which it was proposed to extend over 25 years. The Chief Electrical Engineer (Mr. A. H. Roe) was unable, through illness, to attend; but his Assistant (Mr. Greig) gave evidence explanatory of the system on which the mains were laid. He said the present plant was capable of supplying 4000 8-candle lamps, and it was now supplying 3025. There were eight arc lamps. It was intended to increase the present power by having more machinery at the generating station, and the buildings would be extended. The scheme was to make the additional power equal to the present for both public and private lighting. It was proposed to include 400 incandescent lamps of 25-candle power each, the cost of which would be £120; and the total cost of lighting £6299. The use of gas

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BIRMINGHAM, LONDON, MANCHESTER, LIVERPOOL, AND BRISTOL.

for public lighting purposes would be discontinued. A conditional contract had been made with the Gas Company for the standards and connections to be taken over by the Town Council; £120 was to be allowed. The profit from the electric light works last year amounted to £59. The total revenue for the half year from Sept. 1, 1900, to March 31, 1901, was £534 13s. 7d. It was proposed to expend £311 on the extension of private mains. The Mayor (Mr. T. Shillitoe) mentioned that the lighting of the town at present was very insufficient. It was necessary that it should be increased in some form; and it was thought it would be best to adopt electricity for the purpose.

The Board of Trade, after consideration of the representations made at the inquiry recently held at the Westminster Town Hall with respect to the regulations made by them under the Electric Lighting Acts for ensuring a proper and sufficient supply of electrical energy, have decided to make further regulations amending those previously settled. They are as follows: (1) In these regulations, the expression "principal regulations" means the regulations for ensuring a proper and sufficient supply of electrical energy made by the Board of Trade under the —— Order, ——, and referred to in the letter from the Board of Trade to —— of the —— day of ——. (2) Regulation 5 of the principal regulations shall be read as if the following provision were added at the end thereof: "Provided that, so long as effect is given to the next following regulation, the undertakers shall not be bound, under this regulation or any regulation corresponding thereto, previously made, to comply with any condition which has been or may be imposed thereunder, the effect of which is to prohibit any change in the pressure of the supply to any premises, except with the consent of the consumer." (3) Regulation 6 of the principal regulations shall be read as if the following provision were added at the end thereof: "But where the consumer withholds his consent after the undertakers have offered to comply with the general terms and conditions imposed by the Board of Trade (county council, local authority), and, if not required to do so under those terms and conditions, also to pay the reasonable cost of, or incidental to, the change (including compensation for any loss or damage incurred in consequence of the change), the undertakers may appeal to the Board of Trade, and that Board may, if they think fit, give their consent to the change on such terms and conditions as they impose, and the consent of the Board so given shall, for the purpose of this regulation, have the same effect as the consent of the consumer." The Board of Trade may, if they think it necessary in any case, refer to a single arbitrator appointed by them to determine what terms and conditions it would be proper to impose under this provision in case the consent of the Board is given. Any such arbitration shall be subject to the like provisions as an arbitration in pursuance of a Special Act under Part I. of the Board of Trade Arbitrations, &c., Act, 1874, and shall also be subject to the provisions of the Arbitration Act, 1889, as if the arbitration were pursuant to a submission, except that the powers under the last-mentioned Act with respect to the costs of the reference and award shall be exercised by the Board of Trade instead of by the arbitrator.

The Belfast Borough Council discussed at their last meeting the subject of charging for electric current. It came forward in the minutes of the Gas and Electric Light Committee, which contained the report of a Sub-Committee who had been considering the matter. To this Sub-Committee Mr. M'Cowen, the Electrical Engineer, had submitted a report, in which he pointed out that, broadly speaking, there were two systems of charging for electrical energy: (1) A uniform or "flat-rate" system, with discounts similar to the method employed for charging for gas, whereby large consumers receive large discounts; (2) a sliding-scale or "demand indicator" system, whereby a high price is charged for a certain initial quantity, depending on the consumer's demand, the remainder being charged for at a very low price. By this means the smallest consumer can obtain current as cheaply as the largest. He gave particulars as to average prices for lighting; and expressed the opinion that the suggestion to change from a "demand indicator" to a "flat-rate" system was quite contrary to the best practice, and would be a most retrograde step. The Sub-Committee recommended the Committee to adopt the Engineer's report and the tabulated list of replies in regard to charges for current, and also advised them to abolish meter-rents, but to make the minimum charge for any quantity of current consumed per meter per annum 20s. The Committee adopted the Sub-Committee's minutes, and recommended the Council to adhere to the present system of charging for, and prices of, current. Mr. Shaw thought the present price of 6d. per unit was quite out of proportion, and was prohibitive. The system adopted in Belfast was altogether an unfair one. In his opinion, there should be a fixed price, and then many householders would have the electric light in their houses. From the returns which had been obtained from other towns, but which the Committee had not published as promised, he found that in Edinburgh the price charged was 3¾d. per unit, with discounts; in Bradford, it was 3d.; in Burnley, 3d.; in Chester, 3d.; and in Halifax, 2½d., with 5 per cent. discount. He moved, as an amendment, that the recommendation be referred back to the Committee. Mr. Stewart supported the amendment. He said that, looking at the returns, he found that of the 98 towns 50 per cent. used the "demand indicator" system, and had a uniform charge. The average for the past year in Belfast was 4d. per unit, and he had tried to induce the Committee to fix it as the uniform price. He was convinced that this was the only way to popularize the use of the electric light; and if the Council wanted the undertaking to pay, they must take that course. After discussion, the amendment was negatived by 21 votes to 12.

Lambeth Water-Works Company.—The Directors of this Company have decided, subject to audit, to transfer £5000 to the contingency fund, and to recommend the payment of dividends on the 10 and 7½ per cent. stock for the past half year at the prescribed rates, with the addition of ½ per cent. per annum on account of deficiencies in previous dividends; leaving a balance of about £2700 to be carried forward after making provision for the statutory payment to the Chamberlain's sinking fund.

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NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

It has been reported to the Edinburgh and Leith Gas Commissioners this week that their purchases of cannel, recently made, were as follows: Edmonstone cannel, 13,000 tons; Balbardie cannel, 12,000 tons; Methil shale, 20,000 tons; and Dalquhandy cannel and splint, 500 tons. The Commissioners also contracted, at the same meeting, with the Broxburn Oil Company for the supply of 3000 tons of oil. Of lime, they have purchased, for the coming year, 2000 tons of Pitlessie, 4000 tons of Burdiehouse, 2500 tons of Oxwell Mains, and 500 tons of Cousland. They have undertaken to supply the Corporations of Edinburgh and Leith with gas for public lighting at 2s. 8d. per 1000 cubic feet, which is the present rate.

The Works Committee reported the acceptance of tenders for Granton, as follows: Water-tube condensers for coal gas, Messrs. Clapham Bros.; hydraulic machinery, Messrs. Tannett Walker and Co.; cyanogen plant, Messrs. W. C. Holmes and Co.; and water-tube condensers for steam, Messrs. James Milne and Son. Of general stores, the supply of meters is distributed among the meter makers in Edinburgh; tubes and fittings are to be furnished by Mr. David Richmond and by Messrs. A. & J. Stewart and Menzies; and retorts, by the Glenboig Union Fire-Clay Company and Messrs. P. & M. Hurll. A letter on the subject of the coal contracts, which had been received from Provost Mackie, of Leith, was read, in which he said: "I am advised that you have no legal right to withhold from me information supplied to other members of the Commission; and I again request a copy of all the coal offers, and I again protest against any tenders being accepted until the information is given. I would further like to point out that the question of buying for six or twelve months has not been discussed, unless it is done at the meeting to-day, which I cannot attend." The letter, of which I have given the text, was written on April 12, the day on which the cannel contracts were entered into; and the Clerk thereafter replied to Provost Mackie that the purchases had been made for twelve months. Bailie Manclark, of Leith, who presided, said that the Commission resolved, a year or two ago, that it was not advisable to send offers for coal to any others than the Sub-Committee. Of course, no member of the Commission could be debarred from seeing anything in the office; but it was another question for a Commission like that, dealing largely in coal, to put the prices into the hands of individuals. The schedule containing all the information was on the table at the time the Commission were considering the contracts. Mr. D. Purves, the Convener of the Works Committee, said that if the gentlemen who differed from the procedure which the Commission had adopted proposed a change, and the Commission agreed to the proposal, the responsibility would rest with the Commission; but the Committee, he considered, adopted the course which was laid down to them two years ago. Mr. Mallinson moved that the Clerk write to Provost Mackie, informing him that every document concerning the coal contracts was open for inspection by him at the office. The Chairman thought that the Provost ought to know that; and Mr. Purves was surprised that there should be any doubt on the matter in the minds of any of the members of the Commission. The motion was adopted. Thus, in all probability, the incident will end. I dare say Provost Mackie will scarcely care to make a pilgrimage to the office to inspect the schedule of tenders, because the probability is that he did what he did with the object of taking some action upon it; but now that the contracts have been entered into, the time is past for anything to be done. Any inspection now made would therefore be open to the criticism that it was being done more out of curiosity than from a sense of public duty.

On Wednesday afternoon, there was a suspension for about half-an-hour of the Corporation electric current in Edinburgh. Men were engaged upon some work in a street near the Dewar Place electric station, when, on account of the breaking of a feeder, a short-circuit was set up, and a cable was so much damaged that the current had to be cut off to allow of its being repaired. There was little demand for current for lighting at the time; but all electric motors were brought to a standstill, and great inconvenience ensued.

To see ourselves as others see us, is an experience which, if it is ever realized, is believed to exercise a chastening effect upon the mortal who may be getting too proud of himself or his achievements. We have all been writing very appreciatively of the installation of gas lighting in the International Exhibition in Glasgow. There is another view, which is published as the criticism of a stranger, in a Glasgow newspaper. The writer says: "Last night I visited the grounds, prepared to endure the discomfort of crowding, feeling confident that I would be amply repaid. I am sorry to confess that my disappointmen was great. I am merely stating my own personal opinion—but it was an opinion shared by many with whom I spoke last night—when I say that I consider the lighting of the grounds to have been arranged on quite a wrong principle. The crude white glare which the incandescent lamps send forth kills everything around. All the exquisite proportions of the buildings in the grounds, the soft lights in the bungalows, the main buildings themselves—all are lost to the eye, which is dazzled by this dominating gaslight. Everything is subservient to it. As an exhibition of gas lighting it is admirable; but I appeal to the artistic interest of Glasgow—is it the way to treat the grounds of an Oriental palace at night? To my mind it is too harsh and glaring. One might as well be in Argyle Street as in the main grounds of the Exhibition. I take it that when a visitor leaves the main buildings at night he goes into the grounds not only to breathe the fresh air, but to rest his eyes after the glare of the electric lights inside. What does he find? The grounds more dazzling than the interior. Doubtless it is the intention to introduce fairy lamps later on; but their effect will be largely lost unless the number of gas-lamps is reduced. By all means let there be light, and plenty of it; but it should be soft, mellow light, in keeping with the Oriental character of the buildings, and in harmony with the langorous summer evening that you may shortly expect. I make this criticism in no carping spirit. There is so much that is really excellent in your

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Exhibition, that one can forgive some deficiencies; but I feel compelled to express my great disappointment at the appearance of the grounds last night." It would be bordering on wickedness to suggest that the writer is a person prejudiced because of some interest in electricity, which is being jeopardized by the success of the gas lighting; but there can be no harm in hazarding the opinion that he or she is one of the class of person who have too much soul about them, and who live and move in regions unrealizable to the ordinary intellect—a class which is, fortunately, extremely small.

The Commissioners of the city, and others in good position, having been entertained on the occasion of the opening of the new gas-works at Perth, it was felt that some recognition should be made of the workmen within the works. Accordingly they were, to the number of about fifty, treated to supper in the Windsor Restaurant on Wednesday. Mr. W. Watson, Convener of the Gas Committee, presided.

At the Kilsyth Burgh Commission this week, it has been reported that the use of benzol for enriching the coal gas was giving satisfaction, and that there was a probability of the price of gas soon being reduced. Complaint was made that, on the occasion of a recent fire, the gas was cut off from the whole town, and was then turned on again—a proceeding which was highly dangerous. There was a gas-engine in the building that took fire, which was the reason for the cutting off of the gas; but it was urged that it would have been easy to have severed the pipe outside the building, and thus to have avoided throwing the whole town into darkness. A Committee was appointed to consider a proposal to put down stopcocks at different places, so that, on such occasions, it may not be necessary to cut off the gas supply from the whole town.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *May* 4.

Sulphate of Ammonia.—The improved demand noticed last week has been sustained, and has resulted in a further advance in prices; the closing quotations being £10 5s. to £10 10s. per ton delivered f.o.b. at the ports. Consumers abroad, misled by low speculative quotations in April, having supplied themselves rather sparingly, have had to come forward; and a fair proportion of the business done has been with direct buyers. On the other hand, makers, having for the most part sold their production as it became available, are not burdened with stocks, and can, consequently, afford to take things comfortably. There has been large inquiry in the forward position, and considerable purchases have been made both in Scotland and in London. Having sold May-September at £10 6s. 3d. per ton, f.o.b. Leith, ordinary terms, makers have advanced their ideas. Up to £10 7s. 6d. per ton, Beckton terms, has been paid in London for May-June, and £10 10s. per ton is required at the close for this position.

Nitrate of Soda is firmer in all positions; and the spot quotations have been advanced to 8s. 6d. and 8s. 9d. per cwt. for ordinary and refined qualities, respectively.

LONDON, *May* 4.

Tar Products.—Notwithstanding the great falling off in the production of benzol, as is customary at this time of year, prices seem to go from bad to worse. A sale of 90 per cent. is reported at 6¼d. naked at makers' works, while business is reported for export at 8¾d., casks included, May-September. Of course, the quantity produced from coke-ovens will be greatly lessened, owing to the bad state of the coke trade; but the total absence of Continental demand has a very depressing effect. Crude carbolic is decidedly quiet, owing to the low prices being quoted for crystals by Continental makers. Oils are certainly better, and show signs of improvement. Pitch is quiet; but prices are decidedly weaker. The uncertainty as regards the coal tax is having a depressing effect on this article. Tar is quiet. Prices are certainly easier, although no important contracts have been recently let.

The average values obtaining during the week are: Tar, 14s. to 17s. Pitch, east coast, 29s. to 29s. 6d.; west coast, 27s. to 27s. 6d. Benzol, 90's, 7½d. to 8¾d.; 50's, 7d. to 8d. Toluol, 1s. Crude naphtha, 4d. Solvent naphtha, 1s. 1d. Heavy naphtha, 1s. to 1s. 1d. Creosote, 1¼d. to 1½d. Heavy oils, 2d. to 2¼d. Carbolic acid, 60's, 2s. 6d. Naphthalene, 85s.; salts, 50s. to 55s. Anthracene, "A," 2½d. to 3d.; "B," 2d. (nominal).

Sulphate of Ammonia.—During the last few days, this article has shown signs of improvement, particularly owing to the business which has been done in the Beckton make. On Friday last, sales were made of this make at £10 7s. 6d., when the price was advanced to £10 10s. Business was done at Hull at £10 5s.; and prices have since been advanced to £10 7s. 6d. The demand at Leith appears to have been well maintained. After business had been done at £10 5s., makers raised their quotations to £10 7s. 6d., and in one case business was done at £10 6s. 3d.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—In trade and manufacturing circles generally throughout this district, the extraordinary attitude taken up by the miners with regard to the export duty is being severely criticized; and it is becoming increasingly evident that the opposition pure and simple to the proposed tax is but a very partial reason for the threatened general strike. The suggested cessation of work is looked upon as so absolute an absurdity under the circumstances, that, apart from its seriousness, it might only be treated with ridicule; but it is also an evidence of such utter disregard of the interests of other branches of industry, that the coalowners and the miners need not be surprised if retaliatory measures are adopted as far as possible by the numerous industries that are likely to suffer, while it is certain to alienate all public sympathy with either the men or the masters. Political animosity is, of course, a considerable factor which is just now actuating the miners' leaders in urging on this desperate means of damaging the Government; but underlying this threatened general

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suspension of work is undoubtedly an attempt to artificially bolster up the steadily weakening position in the coal trade, and by so doing defer as long as possible the inevitable reduction in wages. It is only natural that colliery owners should raise no serious objection to any action on the part of the men that would tend to stiffen prices; but the policy which the men's leaders are adopting may cut more ways than one, and in many quarters very little of it would probably be found to go a long way. Except that this extraordinary threatened action by the men is for the time being unsettling the situation in the coal trade, the ultimate course of events is altogether too uncertain to afford any basis for definite conclusions as to the future. For the present, there is a strong tone as regards prices; the month having opened, as previously indicated, with no official reduction of list rates. Neither consumers nor buyers are likely to be rushed into any sort of panic. For house-fire coals, the demand continues to fall off; but until collieries have accumulated stocks, or competition from other districts forces their hands, it is probable they will hold on very closely to the current list rates, which average 16s. to 17s. per ton at the pit for best Wigan Arley, 14s. 6d. to 15s. for Pemberton four-feet and seconds Arley, and 13s. to 14s. for common house coal. Steam and forge coals (which are in but indifferent request) are more plentiful, and easing down gradually—largely as a result of the low-cut prices in other districts. Lancashire steam coals range from 10s. 6d. to 11s. 6d. per ton at the pit, according to quality, with good hand-picked hard coals offering from Derbyshire collieries at as low as 8s. to 8s. 3d. Engine fuel is also in pretty much the same position; and Lancashire collieries are finding their top prices practically unobtainable. The general range of quotations is from about 7s. and 7s. 6d. per ton for common, to 8s. 6d. and 9s. for the better qualities, with slack from other districts offering from as low as 4s. 6d. and 5s. per ton at the pit. Nothing has yet transpired with regard to the forthcoming gas coal and locomotive fuel contracts; and it is, of course, doubtful to what extent the threatened stoppage of the pits may influence the situation. No doubt such a stoppage would be utilized by colliery owners to stiffen up the prices which otherwise they would have been compelled to quote to secure next year's contracts; but there is no indication at present of how the course of the market may turn, and for the most part the whole thing is regarded as little more than a mere matter of bluff. It may be added that, so far as Lancashire is concerned, the foreign exports of coal are comparatively unimportant, and mainly confined to the Continent, and to cannel and other descriptions of gas coal, of which fair quantities are sent abroad. On such high-priced coal as cannel, the export duty of 1s. per ton would scarcely be appreciably felt; and the extent of the trade all through is not such that any disastrous effect can be contemplated. The stoppage of the pits would consequently be nominally to assist other districts, but mainly to restrict the output of coal, with the object of keeping up both prices and wages. The shipping trade has been slow, with prices about as last quoted—averaging 12s. to 12s. 6d. per ton for steam coal, delivered at the Mersey ports. Lancashire foundry cokes have been easing down slightly, owing to competition from the North of England; and there has been an average reduction with the commencement of the month of about 1s. per ton, bringing basis prices at the ovens to about 24s. and 25s. Furnace qualities, on the other hand, are, if anything, stronger; good washed Lancashire cokes averaging 12s. 6d. to 13s. 6d. per ton, with good Yorkshire furnace cokes scarcely obtainable under about 9s. 6d. to 10s.

Northern Coal Trade.—The trade of this district is still excited by the coal tax agitation, and by the efforts that have been needed to get the bonds completed for some of the cargoes of coal that were to be sent abroad. In the steam coal trade, best Northumbrian kinds are firm at from 12s. 9d. to 13s. per ton f.o.b.; and steam smalls are steady at 6s. to 6s. 3d. Gas coals are in fair demand for this season of the year, and there is an abundant supply. No additional contracts are reported, but the price for occasional cargoes is rather firm at from 9s. 3d. to 9s. 9d. per ton f.o.b. Deliveries of gas coals on the large contracts are now at about the lowest range of the year; but some exportations are adding to the volume of the trade. The price, on the average, is relatively high. Coke is quiet; best Durham coke for export being now 17s. to 18s. per ton f.o.b., while the blast-furnace coke trade is rather steadier, with prices varying from 14s. 6d. to 15s. per ton, at the Teesside furnaces. Gas coke is unaltered in price this week; but the production is now lower, and stocks are also less.

Scotch Coal Trade.—The trade is in suspense, awaiting the outcome of the agitation against the tax on exported coal. This derangement is only likely to be temporary; the bigger question being what the effect of the tax will be. There is a good volume of business under contract; but little forward demand is being experienced. So far as can be given, the quotations are: Main 9s. to 9s. 3d. per ton f.o.b. Glasgow, ell 10s. to 10s. 6d., and splint 10s. to 10s. 6d. The shipments for the week amounted to 193,471 tons—an increase of 7125 tons upon the previous week, but a decrease of 21,183 tons upon the corresponding week of last year. For the year to date, the total shipments have been 2,685,207 tons—a decrease of 525,273 tons upon the same period of last year.

New Joint-Stock Companies.—The Wyvenhoe Gas Company, Limited, has been registered with a capital of £5000 in £5 shares, to acquire the interest of Mr. H. Woodall in a contract between himself and Mr. C. G. Grimwood for the acquisition of the freehold gas-works, land and property comprised therein, and to manufacture, sell, and supply gas or electric or other light to the town of Wyvenhoe, Essex. There will be no initial public issue. The first Directors are Messrs. J. L. Cloudsley, C. G. Grimwood, F. R. Smith, W. A. Surridge, and H. Woodall. "Phôs, Limited," is the title of a Company which has been formed with a capital of £30,000, in £1 shares, to adopt an agreement between the Phôs Acetylene Gas Syndicate, Limited, and L. D. Robinson (for the Company), and to carry on the business of manufacturers of, and dealers in, acetylene gas generators, lamps, burners, and all appliances in connection therewith, including the manufacture of calcium carbide. There will be no initial public issue. The Largs Gas Company was registered in Edinburgh last week. The capital is £20,000, in 4000 shares of £5 each.

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Gas-Works Profits of Wigan.—Speaking at the monthly meeting of the Wigan Town Council last Wednesday, Alderman Holmes remarked that, in view of the fact that the ratepayers were overburdened with taxes, when there was an advance of 2d. in the income-tax, and when there was to be an advance of 8d. in the pound in the Wigan poor-rate, he was pleased to be able to say that the net profits of the gas undertaking for the past year amounted to £11,000, notwithstanding that they had had to pay between £7000 and £8000 more for coal than in the previous year.

Another Manager's Defence of Gas.—In the "JOURNAL" last week we referred to the steps which had been taken by Mr. Robert Watson, the Manager and Secretary of the Hertford Gas Company, to combat the threatened competition of electric lighting in his district. We have since received a copy of a circular which is being distributed by Mr. J. H. Brown, the Engineer and Manager of the Ilford Gas Company. He has brought together a striking collection of facts and figures in support of gas, which should certainly carry weight with anyone contemplating the abandonment of that illuminant in favour of the electric light. The Ilford Urban District Council have put forth the statement that a unit of electricity will supply 30 lamps of nominally 8-candle power (240 candle-hours) for 5d.; whereas 1000 cubic feet of the gas supplied by the Ilford Gas Company, consumed with Welsbach burners, will give 18,000 candle-hours for 3s. 10d. As 72 units of electricity would be required to produce this quantity of light, the cost at 5d. per unit would be £1 10s. With the ordinary burner, however, at the reduced price of 3s. 8d. per 1000 cubic feet, which will come into force from the June quarter, gas would cost £4 6s. 3d. per annum, as compared with £5 12s. 6d. for electricity—a difference, roughly, of 30 per cent. in favour of gas.

Sales of Shares.—At the Mart, Tokenhouse Yard, last Tuesday, Mr. Alfred Richards offered for sale, by order of the Directors, some 4 per cent. perpetual debenture stock of the Lea Bridge District Gas Company; and it fetched £105 per £100 of stock. Mr. H. Knowles recently carried out the instructions of the Directors of the Gloucester Gas Company to put up to auction some consolidated ordinary 5 per cent. stock of the Company. It was put up in lots of £100; and they fetched from £120 to £122 each. The sale produced £2526 10s. At the Sun Hotel, Kingston, a few days ago, Messrs. Herrick and Sons submitted to public auction, by order of the Directors, £10,000 of new consolidated ordinary stock, and £2500 of 4 per cent. debenture stock of the Kingston Gas Company. The ordinary stock was put up in £100 and £50 lots; and it realized prices ranging between £121 and £123 10s. each for the former, and from £60 to £60 7s. 6d. apiece for the latter. The debenture stock was in similar parcels; the larger fetching £104, and the smaller £52 and £52 10s. each. The sale produced £14,715 15s. At a recent sale of £25 shares (7 per cent.) in the Winchester Water and Gas Company, the prices realized averaged £38 17s. 8d. apiece; the gross amount produced being £6221 15s. Messrs. Hollis and Webb sold at Leeds, last Tuesday, a new issue of £10 shares (7 per cent.) in the Rothwell Gas Company, at from £15 11s. to £15 13s. each.

Water Supply by Meter.—Water-meters are largely used at Yonkers (N.Y.); the annual report for 1900 showing 4852 on 4968 services. Some of the latter are not used; but, on the other hand, there are 29 services to city buildings and fountains which are supplied free. Mr. A. W. Kingsbury, Clerk of the Water Commission, states that 41,106,000 gallons of water were used for domestic, 29,403,000 gallons for manufacturing, and 938,000 gallons for public purposes. The metered consumption is 48·12 per cent. of the quantity supplied at the stations as measured there by pump displacement, without any deduction.

Malmesbury Water-Works Award.—The Corporation of Malmesbury having decided to purchase the water-works, two Arbitrators were appointed—Mr. J. W. Restler, Engineer of the Southwark and Vauxhall Water Company, for the Corporation, and Mr. J. H. Fielder, auctioneer and valuer, of Malmesbury, for the Water Company. As these gentlemen could not agree upon a figure, an Umpire was called in, in the person of Sir John Whittaker Ellis, who has fixed the amount to be paid by the Corporation at £6540. Application will be made to the Local Government Board to sanction a loan for the purchase of the undertaking.

New Spiral-Guided Holder at Barry.—Last Wednesday, the members of the Barry District Council inspected a new holder at their gas-works, which has been built to meet the increasing demands of the district. The holder has a working capacity of about 650,000 cubic feet, is a three-lift one, and is constructed on the Gadd and Mason principle. The tank is of steel. The inner lift is 105 feet in diameter, by 25 ft. 6 in. deep at the sides; the middle lift is 107 feet in diameter; and the outer lift 110 feet. The tank is 112 feet in diameter and 26 feet deep. The cost will be about £9000. It is not expected that the holder will be used this year.

Roumanian Petroleum.—The progressive nature of the Roumanian petroleum industry during the past few years is indicated by the figures which have just been issued in regard to the production. In 1896, the output amounted to 73,400 tons; in 1897, to 85,000 tons; in 1898, to 135,000 tons; in 1899, to 182,500 tons; and in 1900, to 224,750 tons. In this connection, it is reported from Bucharest that it is doubtful whether a further augmentation in the production will take place during the current year, as a period of stagnation will inevitably arise unless fresh life is imparted to the industry by the formation of new companies with adequate capital at their disposal.

Projected New Gas-Works for Aberavon.—The Gas Committee of the Aberavon Town Council have recently paid visits of inspection to the Pontypridd and Barry gas-works, with the object of obtaining evidence which will assist them in the erection of their contemplated new works. They were convinced that it was absolutely necessary to push forward the project, as thereby very considerable expense would be saved the ratepayers. The general district rates have been assisting the gas-works to the extent of £300 or £400 a year, apart from the very handsome sum which the ratepayers pay over to the concern for street lighting, amounting to something like £612 for 150 lamps.

CARBURETTED WATER-GAS APPARATUS

Merrifield—Westcott—Pearson Patents.

The Economical Gas Apparatus Construction Co., Ld.

W. H. PEARSON, Chairman.
W. H. PEARSON, Junr., Deputy-Chairman.
J. T. WESTCOTT, M.E., Manager.
L. L. MERRIFIELD, M.Inst.M.E., Engineer.

London Offices: 19, ABINGDON STREET, WESTMINSTER, S.W.
American Offices: TORONTO. TELEGRAPHIC ADDRESS: "CARBURETED, LONDON."

CARBURETTED WATER-GAS ENGINEERS.

The above Company have erected since 1893, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—

	Cubic Feet Daily.		Cubic Feet Daily.
BLACKBURN	1,250,000	WINNIPEG, MAN.	500,000
WINDSOR ST. WORKS, BIRMINGHAM	2,000,000	COLCHESTER (Second Contract)	300,000
SALTLEY WORKS, BIRMINGHAM	2,000,000	YORK	750,000
COLCHESTER	300,000	ROCHESTER	500,000
BIRKENHEAD	2,250,000	KINGSTON, ONT.	300,000
SWINDON (New Swindon Gas Co.)	120,000	CRYSTAL PALACE DISTRICT	2,000,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000	DULUTH, MINN.	300,000
WINDSOR ST., BIRMINGHAM (Second Cont.)	2,000,000	CATERHAM	150,000
HALIFAX	1,000,000	LEICESTER	2,000,000
TORONTO	250,000	ENSCHEDE (HOLLAND)	150,000
OTTAWA	250,000	BUENOS AYRES (RIVER PLATE CO.)	700,000
LINDSAY (Remodelled)	125,000	BURNLEY	1,500,000
MONTREAL	500,000	KINGSTON-ON-THAMES	1,750,000
TORONTO (Second Contract; Remodelled)	2,000,000	ACCRINGTON	500,000
BELLEVILLE	250,000	TONBRIDGE	300,000
OTTAWA (Second Contract)	250,000	STRETFORD	500,000
BRANTFORD (Remodelled)	200,000	OLDBURY	300,000
ST. CATHERINES (Remodelled)	250,000	TODMORDEN	500,000
KINGSTON, PA.	125,000	SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
PETERBOROUGH, ONT.	250,000	YORK (Second Contract)	750,000
WILKESBARRE, PA.	750,000	ROCHESTER (Second Contract)	500,000
ST. CATHERINES (Second Contract)	250,000	NEWPORT (MON.)	250,000
BUFFALO, N.Y.	2,000,000	TOKIO, JAPAN	1,000,000

Complete Gas-Works at NELSON, BRITISH COLUMBIA.

ORDERS RECEIVED IN 1901 TO MARCH 1 . . . . 3,500,000 CUB. FT. DAILY.

The Directors of the Oriental Gas Company have resolved to pay an interim dividend at the rate of 3½ per cent., free of income-tax, on account of the year ending on the 30th prox.

For family reasons, the business of Mr. James Gibbs, of the Vitriol Works, Avon Street, Bristol, has been converted into a private limited liability company, under the style of James Gibbs and Finch, Limited; and the head office will be transferred to Cattedown, Plymouth.

The profits realized by the Canterbury Gas and Water Company during the past three years were as follows: In 1898—Gas, £4877; water, £4620; total, £9497. In 1899—Gas, £5498; water, £4296; total, £9794. In 1900—Gas, £5842; water, £4298; total, £10,140.

A very successful exhibition of gas cooking and other appliances was held last week by Messrs. Fletcher, Russell, and Co., Limited, under the auspices of the Southampton Gas Company, in the Victoria Rooms in that town. Lectures and cookery demonstrations were given by Mrs. Collins, and they were listened to by large audiences.

The tenders of the New Conveyor Company, Limited, of Smethwick, were accepted during the past month for installations of inclined retorts at Cambridge and Königsberg (Germany); for ranges of gas-producers at Glasgow, Liverpool, and Montreal; and for coal-handling plant for the electric light works at Newport, Edinburgh, and Hanley, and for the gas-works at Middlesbrough.

Last Wednesday, a demonstration was given in Pimlico of the practical applications of Dr. Hans Goldschmidt's process for the production of high temperatures by the combustion of aluminium, which was described in the "JOURNAL" for the 9th ult. (p. 947). The applicability of "Thermite" to the welding of steel tubes and rails was effectively illustrated on the occasion.

The Desrumaux system for the automatic softening and purification of hard and impure water has been put into operation at the mills of Sir Titus Salt, Bart., Sons, and Co., Limited, at Saltaire. The plant is equal to treating 552,000 gallons of water per day.

While the gas undertaking at Devonport is in a state of transition, says the "Western Morning News," there is to exist a sort of dual control; the Directors of the Company and the Gas Committee of the Corporation sharing the management. Last Wednesday they all met for the first time in the gas-works at Devonport, and conducted some important business in connection with them.

At the Holborn Restaurant last Wednesday, a demonstration took place of the Phôs Company's new system of acetylene lighting as applied to London omnibuses. Mr. D. J. Van Praagh, the inventor, mentioned that the light was first introduced into London omnibuses on the 28th of August last, and since then contracts had been entered into with a number of the Companies.

The profits on the gas undertaking of the Rochdale Corporation are £7000 less than they were a year ago. They were then rather over £19,000; now they are about £12,000. The falling off is accounted for by the increased cost of coals. The Gas Committee recommend the devotion of the whole of the amount to the relief of the rates, which are increased from 6s. 10d. to 7s. 2d. in the pound.

The remainder of the letters of allotment and regret for the new issue of ordinary and preference capital in the Richmond Gas Stove and Meter Company, Limited, were posted on Monday last week. As already mentioned in the "JOURNAL," the entire amount offered was subscribed for twice over by the existing shareholders. After allotting to each shareholder his *pro ratâ* quantity, the remainder of the shares were distributed as widely as possible.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

TERMS OF SUBSCRIPTION to the "JOURNAL."

One Year, 21s.; Half Year, 10s. 6d.; Quarter, 6s. 6d.

Payable in Advance. If credit is taken, the charge is 25s. a year.

Telegraphic Address: "GASKING, LONDON."
Telephone Number: Holborn 121.

All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale than all other Oxides combined. Purity and uniformity of quality guaranteed.

JOHN WM. O'NEILL, Managing Director,
160, 161, & 162, PALMERSTON BUILDINGS,
OLD BROAD STREET,
LONDON, E.C.

ANDREW STEPHENSON, AGENT. All communications re Oxide to the Company as above.

WINKELMANN'S
"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for use in GAS-WORKS.

ANDREW STEPHENSON,
182, Palmerston Buildings,
Old Broad Street,
"Volcanism, London." London, E.C.

BROTHERTON & CO.
Offices: Commercial Buildings, LEEDS.
Correspondence invited.

PATENTS FOR INVENTIONS.
Messrs. J. C. CHAPMAN & CO., Chartered Patent Agents, ADVISE ON ALL MATTERS CONNECTED WITH ABOVE.
Information and Handbook on application.
70, CHANCERY LANE, LONDON, W.C.

SULPHURIC ACID for Sale.
BROTHERTON AND CO., Chemical Manufacturers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

PENNY-IN-THE-SLOT WORK.
H. GREENE & SONS, Ltd., are prepared to give QUOTATIONS to Gas Companies or Corporations for FITTING UP COMPLETE and CARRYING OUT the WORK in its entirety, either in Iron or Compo.
19, FARRINGDON ROAD, LONDON, E.C.
Telegrams: "LUMINOSITY."

GAS TAR wanted.
BROTHERTON AND CO., Tar Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

PRACTICAL RETORT SETTERS.
GEORGE NUTTALL & CO., 32, Havelock Road, Saltley, Birmingham.
Regenerator or other Furnaces erected to Engineers' own Designs. Best Work Guaranteed. Please write for Estimates.

TO GAS AND WATER OFFICIALS.
HIGH-CLASS CYCLES at Reasonable and LOW PRICES. Guaranteed and sent on approval. For Cash or Gradual Payments. Catalogue post free. Old Machines Exchanged or Repaired.
MELROSE CYCLE COMPANY, COVENTRY.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM; and 45 & 47, Westminster Bridge Road, LONDON, S.E.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Addresses:
"Braddock, Oldham." "Metrique, London."

HYDRATED OXIDE OF IRON.
PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Lent on Hire.
Can be Exchanged for Spent Oxide.
READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

SADLER & CO., Ltd., Middlesbrough, Tar Distillers and Tar Colour Manufacturers. BENZOL specially prepared for Gas Enrichment free from Sulphur. Pure Hydrated OXIDE OF IRON for Purifying Gas either for Sale or Lent on Hire. Always Buyers of GAS TAR and AMMONIACAL LIQUOR.

AMMONIACAL LIQUOR wanted.
BROTHERTON AND CO., Ammonia Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SPECIAL PAINT FOR GAS-WORKS.
JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
MANCHESTER.
Telegrams: "ENAMEL." National Telephone 1759.

R. B. FITZ-MAURICE, 4, East India Avenue, London. Foreign and Colonial SHIPMENTS and CHARTERING promptly attended to FIRE, LIFE, and ALL CLASSES of INSURANCES effected on the Lowest Terms.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

SULPHATE OF AMMONIA
SATURATORS and LEAD WORK for Sulphate of Ammonia Plants.
For REPAIRS or ALTERATIONS, ring up "0848 BOLTON," or Telegraph "SATURATORS, BOLTON."
Largest Practice and most Up-to-Date Works in Britain.
JOSEPH TAYLOR AND CO., Central Plumbing Works, Victoria Square, BOLTON.

GENTLEMAN well up in all Branches of Gas and Water Works Engineering, representative of an eminent Firm of Carbonizing Engineers, with Offices in Westminster, will be glad to REPRESENT one or two firms of good repute.
Apply to Mr. P. INFANTE, 34, Victoria Street, WESTMINSTER, S.W.

OXIDE OF IRON OF FINEST QUALITY.
BALE'S Special Fire Cement should be used to keep Retorts, Furnaces, &c., in good repair during the heavy Winter Work.
Send for full Particulars to
BALE & CO., 120 & 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."
Telephone "277 HOLBORN."

GAS-STOVE TRADE.
FIRST-CLASS Representative wanted, able to Organize and Develop Business. Must be fully Qualified and Experienced.
Apply, by letter, to No. 3684, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO GAS-WORKS MANAGERS.
WANTED, a Working Manager for a Small Gas-Works in Spain, making between 5 and 7 million cubic feet per annum. It is necessary that the Manager should be a good practical man, and that he should speak and write Spanish.
GEO. BOWER, St. Neots, HUNTS.

DRAUGHTSMAN.
WANTED, immediately, an experienced, clever DRAUGHTSMAN, who thoroughly understands Mechanical and Architectural Plans for a Gas-Works; also to act as Clerk of Works when required.
Apply, by letter, to No. 3686, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

HUNTON BRIDGE AND ABBOTS LANGLEY GAS COMPANY.
WANTED, a Working Manager (Married and an Abstainer), for a small Gas-Works. Annual make about 4 to 5 Millions. Must be a good Carbonizer and practical Mechanic. Able to Lay Services and Connect Meters. Wages, 25s. per Week, with House, Coal, and Gas.
Apply, in own handwriting, with recent Testimonials, on or before the 15th day of May, 1901.
The appointed Candidate will be required to commence his duties shortly.
Applications to be sent to THOMAS S. GODWIN, 60, London Road, Bushey, HERTS.

GAS-WORKS MANAGER.
THE Directors of a fast increasing Works in England, at present making over 200 million cubic feet per annum, require a competent Man who would devote himself to the economical management of their business. He must have Engineering Knowledge to Design, Specify, Estimate, and carry out modern Apparatus and Buildings of Gas-Works, and be a fair Chemist, able to apply and work out Tests of Gas and Residuals. Possible Candidates (whose communications if desired will be kept private) are invited to send Particulars of the capacity of the Works they are now engaged in, the make of Gas per ton and per mouthpiece, the percentage of Fuel used per ton of Coke made, together with class of Furnaces in use. They will also state approximate Age and whether Married. Communications with those first selected will subsequently embrace the questions of Certificates, Salary, &c., &c.
Address not later than the 25th of May current, No. 3687, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

EXPERIENCED Surveyor and DRAUGHTSMAN required for large Provincial Water Company. Must be well up in Theodolite Work.
Applications, stating Age, Experience, and Salary required, to No. 3677, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Manager's Clerk in a large Gas-Works. Shorthand and Typewriting necessary. Commencing Wages 25s. per week.
Apply, by letter, to No. 3667, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

MECHANIC and Blacksmith wanted, willing to make himself generally useful on the Works.
State previous Employment, Age, Wages required, and enclosing *copies* of Testimonials, to A. E. LAYTON, Manager, Gas-Works, REDDITCH.

A RATING Surveyor engaged in valuing Gas-Works for Parochial Assessments, which are now being appealed against, requires the services of a Competent GAS ENGINEER (one who has retired preferred), to speak to the value of Gas Plant, Buildings, &c.
Apply, with full Particulars as to experience, to C., 20, Albany Villas, Hove, SUSSEX.

WANTED, for a large Gas-Works in the Midlands, a thoroughly competent GENERAL FOREMAN. A knowledge of Gas Manufacture not essential; but must be a good Mechanic, and accustomed to Machinery and the Management of Men.
Address, in own handwriting, stating Age, present Occupation, Qualifications, and Salary required, and enclosing *copies* of recent Testimonials, to No. 3682, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Gas-Works on Lease or Purchase, by thoroughly practical Gas Engineer.
Address No. 3665, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, two good second-hand PURIFIERS, 10 ft. square, with Valves and Connections complete. Also Lifting Gear for same.
State full Particulars, Price, &c., to No. 3685, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ALTON GAS AND COKE COMPANY.

WANTED, Two or Three Good Second- hand PURIFIERS, 20 ft. to 24 ft. square, with Grids. No Connections.
Full Particulars to the MANAGER, Gas-Works, Alton, HANTS.

WANTED, 10,000 Tons of Gas Coal for Belgium, delivered free waggon Forest-Midi or free lighter Anderlecht.
Offers to AUG. KLÖNNE, Dortmund, GERMANY, Contractor for Municipal Gas-Works, Saint-Gilles-lez-Bruxelles.

FOR SALE—One 5000-Cubic Feet per hour STATION METER, in good condition.
Apply to the MANAGER, Gas-Works, Tipton, STAFFS.

FOR SALE—Seven second-hand Mouth- pieces, 21 in. by 15 in. ⌂ shape, with duplicate Lids,
Apply to the MANAGER, Gas-Works, ROMSEY.

SURPLUS NEW GAS PLANT FOR SALE.

TO BE SOLD, Gasholders, 25 ft. by 10 ft., 40 ft. by 12 ft., and 50 ft. by 15 ft. WET METERS in Cast-Iron Cases. STATION METERS to pass 15,000 cubic feet per hour. Slide and Rising Plug and Change Valves, &c.
GEO. BOWER, St. Neots, HUNTS.

WIDNES GAS-WORKS.

FOR SALE—Seven Sets of Second-hand ⌂ shape RETORT MOUTHPIECES, 15 in. by 18 in., for Settings of Sixes, with Self-Sealing Lids. West's make. Will be put into thorough working order before being sold.
Apply to the MANAGER.

TO BE SOLD—
SINGLE GASHOLDER, 30 ft. by 10 ft. Five Columns.
SINGLE GASHOLDER, 22 ft. by 10. ft. Four Columns.
SIX DONKEY PUMPS, various sizes to 20-horse power.
Write J. WRIGHT, Bridge House, BLACKFRIARS, E.C.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY Gas Engineer, Thornhill, DEWSBURY.

COUNTY BOROUGH OF WARRINGTON.
(GAS DEPARTMENT.)

THE Gas Committee of the above Borough invite TENDERS for the supply of 25,000 to 30,000 Gallons of BENZOL for One Year from the 1st of June next. Also 10,000 Gallons for immediate delivery.
Further Information can be obtained on application to Mr. W. S. Haddock, Gas Engineer.
FREDK. TAYLOR, Secretary.
Gas Offices, Warrington, May 3, 1901.

FOR IMMEDIATE SALE.

OWING to the Introduction of Elec- tricity for the Public Lighting, the Sleaford Gas Company, Limited, have FOR SALE, 137 LAMP COLUMNS, BRACKETS, and COPPER LANTERNS. Many of the Lanterns are practically new, fitted with No. 4 Kern Burners, Auto-Taps, and Anti-Vibrators. Also One Large LAMP COLUMN, fitted with Arc Lamp and Three No. 4 Kern Burners, complete.
For Photos, Prices, &c., apply to H. WIMHURST, Engineer and Manager, Gas-Works, SLEAFORD.

COUNTY BOROUGH OF BLACKBURN.
(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the surplus TAR made at their Works during the Year ending the 30th of June, 1902.
The Estimated Quantity is 2600 Tons; and Tenders are to state a Price for same delivered into Tank-Waggons at the new Gas-Works Sidings, Greenbank.
Forms of Tender may be obtained from the undersigned, and to be delivered in sealed Envelopes, endorsed "Tar," before Saturday, the 18th of May. 1901.
S. R. OGDEN, Engineer and Manager.
Gas Department, Municipal Offices, Blackburn, May 1, 1901.

THE DUNDEE GAS COMMISSIONERS (DUNDEE CORPORATION).

TENDERS FOR COAL.

THE Dundee Gas Commissioners are prepared to receive TENDERS for a SUPPLY of CANNEL GAS COAL, SPLINT, and COKING COAL, for delivery over a period, in the option of the Commissioners, of Six, Nine, or Twelve Months.
Offers must be made on a Printed Form of Tender, which embodies the Conditions of Contract, and which may be obtained on application to the Engineer, at the Gas-Works, Dundee.
The Commissioners reserve power to accept any Quantity they may think fit of any Tender, or to reject any or all of the Tenders.
Tenders to be enclosed, marked "Tender for Coal," and delivered to the Subscriber at his Office, City Chambers, Dundee, not later than the 15th of May, 1901.
THOS. THORNTON, Clerk of the Commissioners.
City Chambers, Dundee, May 1, 1901.

MARKET HARBOROUGH URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

TO SULPHURIC ACID MAKERS.

THE Gas Committee of the above Council are prepared to receive TENDERS for the supply of SULPHURIC ACID during the Twelve Months ending the 31st of May, 1902.
Particulars may be obtained from the undersigned, to whom sealed Tenders, endorsed "Tender for Acid," must be delivered on or before the 24th inst.
A. T. HARRIS, Engineer and Manager.
Gas Offices: St. Mary's Road, Market Harborough, May 3, 1901.

MARKET HARBOROUGH URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

TENDERS FOR GAS COAL.

THE Gas Committee of the above Council are prepared to receive TENDERS for the supply of 3500 Tons of best screened GAS COAL or NUTS, to be delivered Market Harborough Station as may be required during the Year ending the 31st of May, 1902.
The Committee reserve the right to accept Tenders for the whole or any portion of the quantity offered, and do not bind themselves to accept the lowest or any Tender.
Forms of Tender and any further Information may be obtained on application to the undersigned, to whom sealed Tenders, endorsed "Tender for Coal," must be delivered on or before the 24th inst.
A. T. HARRIS, Engineer and Manager.
Gas Offices: St. Mary's Road, Market Harborough, May 3, 1901.

MILTON-NEXT-SITTINGBOURNE URBAN DISTRICT COUNCIL.

STATION GOVERNOR AND GAS-MAINS WANTED.

THE Council of the above District are prepared to receive TENDERS for Delivery, free at Milton, of the following:—

40	9-ft.	Lengths of 8-in.	GAS-MAINS.
74	9-ft.	,, 6-in.	,,
335	9-ft.	,, 4-in.	,,

SPECIAL CASTINGS, at per Ton.
Two Tons of PIG LEAD.
Also one STATION GOVERNOR, 8-inch Connections, to be erected at the Gas-Works (complete).
Further Particulars, with Specifications, will be supplied on application to the Manager, Mr. A. Davison, Gas-Works, Milton-next-Sittingbourne.
Sealed Tenders, endorsed "Gas-Mains," to be addressed to the Chairman, Milton-next-Sittingbourne Urban District Council.
The Tenders should be sent or delivered to me on or before Monday, the 13th of May, 1901.
The Council do not bind themselves to accept the lowest or any Tender.
By order.
WM. PARHAM, Clerk.
Milton-next-Sittingbourne, Kent, May, 1901.

BOROUGH OF COLNE.
(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for a ROTARY SCRUBBER of a Capacity of 1½ Million Cubic Feet per diem.
Further Particulars may be obtained from the undersigned, to whom Tenders must be addressed and delivered not later than Ten a.m., on Thursday, the 9th day of May, 1901.
FRED THORPE, Engineer and Manager.
Gas-Works, Colne, Lancs., May 2, 1901.

DENTON URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

TAR.

THE Gas Committee invite Tenders for TAR, the same to be sent in on or before the 18th of May inst.
Particulars to be obtained from the Gas Engineer, Mr. J. Chadwick Smith, Gas-Works, Denton, near Manchester.
The Committee do not bind themselves to accept the highest or any Tender.
By order,
WM. RICHARDS, Clerk of the Council.
April 29, 1901.

COUNTY BOROUGH OF SALFORD.
(GAS DEPARTMENT.)

TENDERS FOR COAL.

THE Gas Committee invite Tenders for the supply of COAL and CANNEL required at their Works during a period of One Year.
Forms of Tender may be obtained on application to the Gas Engineer, Gas Offices, Bloom Street, Salford.
Sealed Tenders, endorsed "Tenders for Coal," addressed to the Chairman of the Gas Committee, Town Hall, Salford, to be delivered to me not later than Three p.m. on Thursday, the 16th of May, 1901.
The Committee do not bind themselves to accept the lowest or any Tender.
L. C. EVANS, Town Clerk.
Town Hall, Salford, May 3, 1901.

COUNTY BOROUGH OF BURTON-UPON-TRENT.

TO COLLIERY PROPRIETORS.

THE Gas and Electric Light Committee invite TENDERS for the supply of COAL and CANNEL for their Gas-Works. The approximate quantities required during the Twelve Months from the 1st of July will be: Best Gas Coal, 35,000 Tons; Cannel, 5000 Tons.
It is requested that Tenderers should offer these quantities or part thereof (the deliveries to extend over the Twelve Months named), and also proportions thereof for Three, Six, and Nine Months.
Forms of Tender and Conditions of Supply may be obtained from the undersigned, to whom Tenders, endorsed "Coal," must be delivered on or before Wednesday, the 29th day of May, 1901.
The Committee do not bind themselves to accept any Tender.
F. L. RAMSDEN, Manager and Engineer.
The Gas and Electric Light Works, Burton-upon-Trent, May 1, 1901.

CROMER, NORFOLK.

TENDERS FOR COAL.

THE Directors of the Cromer Gas Company are prepared to receive TENDERS, from Colliery Proprietors only, for the supply of 3000 Tons, more or less, of first-class GAS COAL, to be delivered at the Company's Siding, Midland and Great Northern Railways, Cromer, between the 1st day of July next and the 30th of June, 1902, Weight given to be stated.
Deliveries to be made in such quantities, and at such times, as may be required by the Company.
Payment, Net Cash Monthly.
Sealed Tenders, endorsed "Tender for Coal," to be sent to the undersigned, on or before the 20th day of May inst.
Forms of Tender are not supplied.
The Directors do not bind themselves to accept the lowest or any Tender.
By order,
P. E. HANSELL, Secretary.
Cromer, May 4, 1901.

TYLDESLEY-WITH-SHAKERLEY URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

THE above Council invite Tenders for:—
One GASHOLDER and STEEL TANK.
Three STEEL TANKS.
FLOOR-PLATES for Retort-House.
One PUMP.
FURNACE for BOILER.
6000 square feet of PURIFIER-GRIDS.
EXCAVATION for Gasholder Tank.
Supply and setting fourteen RETORTS.
Specification, Form of Tender, and all Particulars can be obtained upon application to W. H. S. Gendall, Engineer and Manager, Gas-Works, Tyldesley, near Manchester.
Tenders, endorsed "Gas-Works," addressed to me the undersigned, to be delivered at the Council Offices, Tyldesley, not later than the 13th of May inst.
The Council do not bind themselves to accept the lowest or any Tender.
By order of the Council,
WM. J. MATTHEWS, Clerk.
Council Offices, Tyldesley, near Manchester, May 2, 1901.

BOROUGH OF TORQUAY.

THE Gas-Works Committee of the Torquay Town Council are prepared to receive TENDERS for the supply of 1200 Tons of approved GAS COALS, delivered free into Stores at the St. Mary Church Gas-Works.

Further Particulars and Forms on which Tenders must be submitted may be obtained at my Office.

Sealed Tenders, endorsed "Tender for Gas Coals," to be sent to the undersigned not later than 9.30 a.m., on Thursday, May 23, 1901.

The lowest or any Tender will not necessarily be accepted.

FREDK. S. HEX,
Town Clerk.

Town Hall, Torquay,
April 30, 1901.

BOROUGH OF CHORLEY.

(GAS DEPARTMENT.)

THE Gas Committee are prepared to receive OFFERS for the supply, delivery, and erection on their foundation of a NEW 50,000 or 60,000 cubic feet per hour STATION METER, or a SECOND-HAND METER of the same size, fitted with entirely new Drum, and in complete working order, both Meters without Inlet, Outlet, or Bye-Pass Valves, &c.

Any further Information may be obtained from Mr. J. W. Allin, Gas Engineer, Chorley.

Tenders, endorsed "Meter," to be delivered not later than Tuesday, May 21, 1901, addressed to the undersigned.

By order,
JNO. MILLS,
Town Clerk.

Town Hall, Chorley,
May 1, 1901.

BOROUGH OF ABERAVON.

THE Corporation are prepared t. receive TENDERS for 1000 to 2000 Tons of large GAS COAL, and 200 Tons of good Coke-producing CANNEL, to be delivered at the Port or Aberavon Stations in such quantities as required by the Gas Manager.

The Corporation reserve the right to divide the Tenders between two or more Contractors, and do not bind themselves to accept the lowest or any Tender.

No Forms of Tender are supplied, but a Schedule of quantities can be obtained from Mr. Walter Lister, the Gas Manager.

Sealed Tenders, endorsed "Tenders for Coal," to be sent to me on or before Five o'clock, the 13th inst.

By order,
M. TENNANT,
Town Clerk.

Aberavon,
May 1, 1901.

TO LIME MASTERS.

THE Corporation of Walsall invite TENDERS for the supply of about 800 Tons of LIME, which will be required at their Gas-Works during One Year from the 1st of July next; the deliveries to be in such monthly quantities as the Manager of the Gas-Works may from time to time direct.

The Lime is to be Hand-picked, and clear from Refuse and Ashes, and to be delivered at the Corporation Siding at the Pleck Gas-Works as required.

Payments monthly.

Tenders, sealed and marked outside "Tender for Lime," are to be sent to the undersigned on or before Saturday, the 25th of May inst.

JOHN R. COOPER,
Town Clerk.

Borough Offices, Walsall,
May 3, 1901.

BARRY URBAN DISTRICT COUNCIL.

THE Gas and Water Committee are prepared to receive TENDERS for the supply and delivery of about 10,500 Tons of GAS COAL, between July 1, 1901, and June 30, 1902, in such quantities, and at such times, as the Engineer and Manager, Mr. F. M. Harris (of whom any further Particulars can be obtained) may require.

The Person or Persons whose Tender is accepted will be required to enter into a Bond, with approved Securities, for the due performance of the Contract.

The Committee do not bind themselves to accept the lowest or any Tender.

Sealed Tenders, endorsed "Tender for Coal," giving the names of the Pits from which the Coal will be raised, and the price per ton of 20 cwt., delivered into the Sidings, at the Gas-Works, Barry, to be addressed to the Chairman of the Gas and Water Committee, Barry Urban District Council, Barry, Glamorgan, on or before May the 18th inst.

Gas and Water Offices, Barry,
Glamorgan, April 30, 1901.

MOUNTAIN ASH URBAN DISTRICT COUNCIL.

(GAS-WORKS.)

TO BUILDERS AND IRON FOUNDERS.

THE Council invite Tenders for Exten- sions at their Penrhiwceiber Gas-Works under two Contracts—

Contract No. 2 being for the erection of THREE OVENS of Six Retorts and firing on Hislop's Shallow Chamber Regenerative System.

Also Contract No. 3 for the BENCH and RETORT MOUNTINGS required.

Drawings and Specifications may be seen, and Form of Tender obtained, on and after the 9th inst., at the Office of Mr. John Williams, Town Hall, Mountain Ash, on payment of Two Guineas in each case, which will be returned on receipt of *bonâ-fide* Tenders.

Sealed Tenders, to be sent to the undersigned, on or before the 21st of May, and endorsed "Gas Extensions, Contract No. 2," and "Gas Extensions, Contract No. 3," respectively.

By order,
H. P. LINTON,
Clerk to the Council.

Town Hall, Mountain Ash,
May 1, 1901.

CORPORATION OF STAFFORD.

THE Gas and Electricity Committee of the above Corporation invite TENDERS for the surplus TAR to be produced at their Works over the period of Twelve Months, commencing the 1st of June, 1901.

Quantity of Coal Carbonized, about 14,000 Tons.

Sealed Tenders, endorsed "Tar," to be addressed to the Chairman, Gas and Electricity Committee, Gas Offices, Chell Road, Stafford, and to be delivered on or before Thursday, the 9th of May, 1901.

The Committee do not bind themselves to accept the highest or any Tender.

Any further Particulars may be obtained, on application, from the undersigned.

(Signed) HUBERT POOLEY, Assoc.M.Inst.C.E.,
Engineer and Manager.

Gas Offices, Stafford,
April 26, 1901.

COUNTY BOROUGH OF SALFORD.

(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the supply of RETORT MOUTHPIECES, ASCENSION-PIPES, HYDRAULIC MAIN COVERS, &c., required at their Liverpool Street Gas-Works.

The Drawings may be seen, and *copies* of Specification and Form of Tender obtained, on application to the Gas Engineer, Gas Offices, Bloom Street, Salford.

Sealed Tenders, endorsed "Retort Mouthpieces, &c.," addressed to the Chairman of the Gas Committee, Town Hall, Salford, to be delivered to me not later than Three p.m., on Thursday, the 16th of May, 1901.

L. C. EVANS,
Town Clerk.

Town Hall, Salford.

CANTERBURY GAS AND WATER COMPANY.

TENDERS FOR GAS COALS.

TENDERS are invited for the supply of 14,000 Tons of the best GAS COALS, to be delivered during One Year, commencing on the 1st of June next.

Forms of Tender, containing Particulars and Conditions of the Contract, may be obtained on application to the undersigned.

Sealed Tenders, endorsed "Coals," to be delivered at the Company's Offices, Castle Street, Canterbury, on or before Saturday, the 18th of May next.

By order,
JAMES BURCH,
Secretary and General Manager.

April 22, 1901.

LIVERPOOL UNITED GASLIGHT COMPANY.

TENDERS FOR CANNEL AND COAL.

THE Directors of the Liverpool United Gaslight Company are prepared to receive TENDERS for the supply of 90,000 Tons of CANNEL, and 180,000 Tons of COAL, to be delivered at the various Works of the Company during the period of Twelve Months, between the 1st of July, 1901, and the 30th of June, 1902.

Tenders will be received for the whole or any portion of the above quantity.

The Directors reserve the right to accept Tenders for the whole or any portion of the quantity offered, and do not bind themselves to accept the lowest or any Tender.

Full Particulars and printed Forms of Tender can be obtained on application to the undersigned, at the Gas Office, Duke Street, Liverpool, to whom Tenders (on the printed Form only) must be delivered, at or before Ten a.m., on Wednesday, May 15, endorsed "Tender for Cannel and Coal."

By order,
WILLIAM KING,
Engineer.

Gas Office, Duke Street,
Liverpool, April 26, 1901.

BROMLEY GAS CONSUMERS' COMPANY.

SALE BY AUCTION OF ORDINARY SHARES OF £10 EACH.

THE Directors give Notice that they have instructed Messrs. BAXTER, PAYNE, AND LEPPER, to SELL BY AUCTION, at the Bell Hotel, Bromley, Kent, on Thursday, the 23rd day of May, 1901, at Eight o'clock p.m. precisely, about

353 ORDINARY SHARES OF £10 EACH,

in the Bromley Gas Consumers' Company, in Lots of Five and Ten Shares. The Dividend on similar Shares since the Year 1898 has been at the rate of 9 per cent. per annum.

Particulars and Conditions of Sale may be obtained of the Secretary of the Company, and of Baxter, Payne, and Lepper, Auctioneers and Land Agents, Market Square, Bromley, Kent, and 69, King William Street, E.C.

By order,
HENRY WILLIAM AMOS,
Secretary.

Gas Offices, Bromley, Kent,
May 1, 1901.

ANDOVER (HANTS) GAS AND COKE COMPANY, LIMITED.

NOTICE OF SALE OF 300 £10 SHARES

In the above prosperous Undertaking, which has for the past Seven Years paid a Dividend of 10 per cent. per annum.

MESSRS. FREDERICK ELLEN & SON will SELL BY AUCTION, at the Mart, Andover, on Wednesday, the 15th of May, 1901, at Three o'clock

300 £10 SHARES

IN THE

ANDOVER GAS AND COKE COMPANY, LTD.

Part of the new issue authorized for the enlargement of the Plant and capabilities of the Works rendered necessary by the continuous increase of the Company's Business.

Further Particulars may be had of Messrs. LAMB AND SON, Solicitors, ANDOVER; or of the AUCTIONEERS.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held PERIODICALLY, at the Mart, Tokenhouse Yard, E.C.

He also undertakes the issuing by AUCTION of GAS and WATER STOCKS and SHARES under Parliamentary Powers.

Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

WEST HAM GAS COMPANY.

NEW ISSUE OF 2500 £10 ORDINARY SHARES.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Monday, May 13, at Two o'clock, in Lots.

Particulars of the SECRETARY of the Company, at the Offices, Union Street, STRATFORD; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

SOUTHEND GAS COMPANY.

NEW ISSUE OF £4200 NEW ORDINARY STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, May 14, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

SOUTHEND WATER-WORKS COMPANY.

NEW ISSUE OF £2700 FOUR PER CENT. PERPETUAL DEBENTURE STOCK, AND 500 £10 NEW ORDINARY SHARES.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, May 14, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

STOCKS AND SHARES

IN THE

NORTHFLEET AND GREENHITHE GAS COMPANY.

ISLE OF THANET GAS COMPANY (supplying Margate), and

GORING AND STREATLEY GAS AND WATER COMPANY.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, the 14th of May, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

CHIGWELL, LOUGHTON, AND WOODFORD GAS COMPANY.

400 £10 ORDINARY SHARES.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, the 4th of June, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

LOWESTOFT WATER AND GAS COMPANY.

NEW ISSUE OF £1300 FOUR PER CENT. PERPETUAL DEBENTURE STOCK, AND 400 £10 ORDINARY SHARES.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, June 4, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

MORTGAGEES' SALE.

IMPORTANT TO MANUFACTURING CHEMISTS AND OTHERS.

TO BE SOLD, the Lessee's interest in the Buildings, Lands, and Premises, containing about 1¼ acres, known as LITTLE ISLAND CHEMICAL WORKS, Co. Cork, together with the Machinery, Fixtures, and Plant attached thereto.

The Premises are situate on the Shore of the River Lee, about 5 miles from the City of Cork. There is a private Wharf where Vessels can load at the very door of the Factory. The business of manufacturing Aniline Dyes, Creosote, Pitch, &c., from Coal Tar has been for some Years, and is still, carried on at these premises.

For further Information, apply to GREGG, JERMYN, AND SONS, Solicitors, CORK.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

Foolscap 4to, pp. 535, with 239 Illustrations and Steel Plate Engraving (as Frontispiece) of WILLIAM MURDOCH, *Inventor of Gas Lighting. Morocco Gilt, 21s.; Roan Gilt, 18s.*

THE SIXTH (AND CENTENARY) EDITION
OF THE

HANDBOOK
FOR
GAS ENGINEERS AND MANAGERS.

BY
THOMAS NEWBIGGING,
M.Inst.C.E.

LONDON:
WALTER KING, 11, BOLT COURT,
FLEET STREET, E.C.

WELDON MUD
FOR
GAS PURIFICATION.

For use in the
RECOVERY OF SULPHUR,
ALSO
Removal of last Traces of SULPHURETTED HYDROGEN in catch position.

Full Particulars on application to the Patentees:
GAS DESULPHURIZATION CO.,
— LIMITED, —
1, FENCHURCH AVENUE, LONDON, E.C.

HOLMSIDE
GAS COALS.
Present Daily Produce over 5000 Tons.

Latest Analysis—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation

Yield of Gas per Ton . . .	11,205 Cubic Feet.
Illuminating Power	16$\frac{7}{10}$ Stand. Sperm Candl.
Coke (of good & pure quality)	18¾ Cwt. per Ton.
Sulphur	A little over 1 per Cent.
Ash	Under 1 per Cent.
Tar	163 lbs. (Avoir.) per Ton.
Ammoniacal Liquor	103 lbs. (Avoir.) per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR
PELTON GAS COALS.
Present Daily Produce available 3000 Tons.

Of equal quality to the "Holmside" Coal, and also very largely used by many Gas Companies at Home and Abroad.

Both descriptions are shipped at Tyne Docks, and Dunston Staiths, River Tyne, also at North and South Docks, Sunderland.

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,
HOLMSIDE & SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

NITRATE of Thorium and Cerium.
FABRIK CHEMISCHER PRAEPARATE VON STHAMER, NOACK, AND CO., HAMBURG.

PRICE'S COKE & COAL BARROW

effects a great saving of time, labour, and expense.

For Particulars Price, &c., apply to Mr. EDWARD PRICE, "Langley," Wyke Avenue, WORTHING.

Prices are Reduced.

HARDMAN & HOLDEN, LD.
ESTABLISHED 1820.
SULPHURIC ACID.

GUARANTEED absolutely free from Arsenic and of excellent Purity. Specially prepared for Sulphate of Ammonia Manufacturers.

Works: BLACKBURN; Miles Platting and Clayton, MANCHESTER.
Head Office: Miles Platting, MANCHESTER.
Inquiries Solicited.

THOMAS TURTON AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.

LONDON OFFICE:
90, CANNON STREET, E.C.

FOR SALE, EXCEPTIONAL BARGAIN IN SECOND-HAND
ANNULAR CONDENSERS
as per Illustration below.

In perfect Order and Condition.
Complete with 16-inch Valves and Connections.
Diagonal Tubes dispensed with if desired.

Cheap, less than Half New Price accepted.
J. FIRTH BLAKELEY & CO.,
THORNHILL, DEWSBURY.

Inspection Invited. Photo, &c., on application.

ARMSTRONG'S PATENT
CANDLE SAFETY LAMPS.

No. 1. No. 2. No. 3.
43, MANCHESTER STREET, GRAY'S INN ROAD, W.C.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH N.B.

HYDRAULIC BLOWER
For blowing Air into Gas Purifiers for the purpose of
REVIVIFYING THE FOULED OXIDE.

Full Particulars on application.

LUXWERKE LUDWIGSHAFEN AM RHEIN.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for
CANNEL & COAL.

TYNE
BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	17·8 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles
Coke	73·1 per cent

For Prices and complete Analysis, apply to
THOS. W. DANCE, SON, & HUNTER,
COAL OWNERS, NEWCASTLE-ON-TYNE;
OR
E. FOSTER & CO.,
21, JOHN STREET, ADELPHI, LONDON, W.C.

JOSEPH EVANS & SONS, CULWELL WORKS WOLVERHAMPTON

PLEASE APPLY FOR CATALOGUE No. 8.

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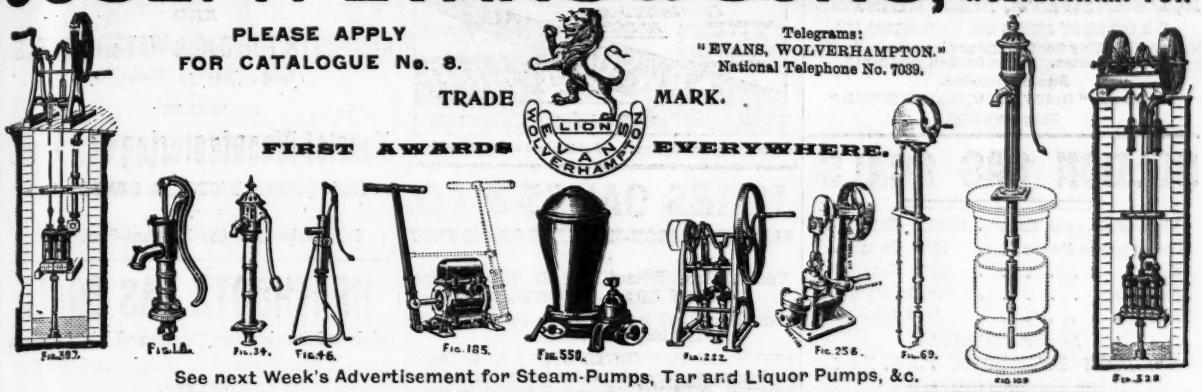
TRADE MARK.

FIRST AWARDS EVERYWHERE.



See next Week's Advertisement for Steam-Pumps, Tar and Liquor Pumps, &c.

Cambridge Scientific Instrument Co., LTD., CAMBRIDGE.

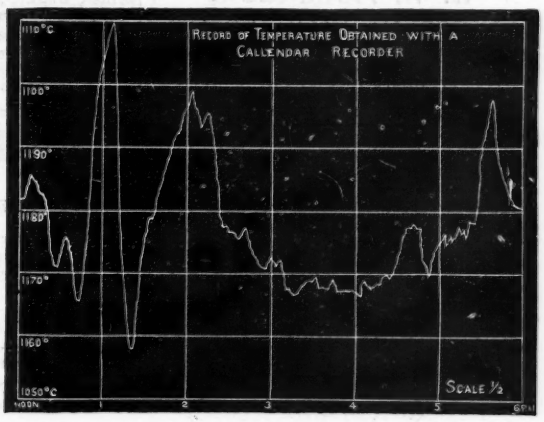
CALLENDAR'S ELECTRIC RECORDING PYROMETERS

Especially adapted for measuring the Temperatures obtained in Water-Gas Plant and Retorts.

Prices and Particulars, together with a Record Sheet obtained with the Instrument, will be sent on application.

ADDRESS ALL COMMUNICATIONS—

"INSTRUMENT CO., CAMBRIDGE."



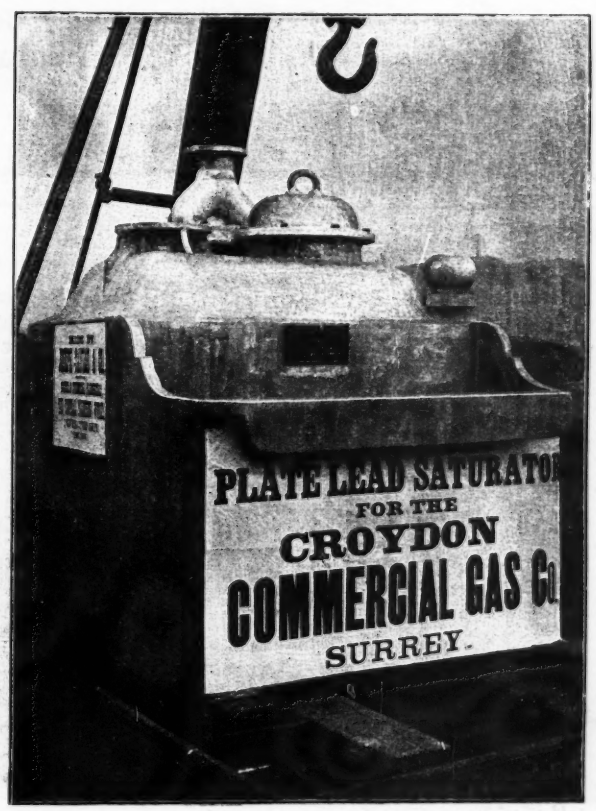
JOSEPH TAYLOR & CO.

CENTRAL PLUMBING WORKS, BOLTON.

Saturator supplied to the Croydon Commercial Gas Co., February, 1898. Still standing straight.

Can guarantee same against leakage for four years for 2½ per cent. on original outlay.

When finally worn out, can supply one with three years' guarantee, free of cost, for the old lead.



76 SATURATORS DELIVERED DURING THE LAST SIX YEARS.

Telegraphic Address: "SATURATORS, BOLTON."
Telephone: No. 0848.

THOMAS DUXBURY & CO.,
16, DEANSGATE, MANCHESTER.
GAS ENGINEERS' AGENTS AND CONTRACTORS FOR
Meters, Fire-Clay Goods, Oxide of Iron, and all other Gas Apparatus. Retort Carbon purchased.
Inquiries Solicited.
Telegrams: "DARWINIAN, MANCHESTER."
Telephone 1806.

BOLDON GAS COALS.

Yield of Gas per Ton. .	10,500	Cubic Feet
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

As per Analysis by
Mr. JOHN PATTINSON, F.I.C., F.C.S.

For Prices, &c., apply to
W. H. PARKINSON,
THE HARTON COAL CO., LTD.,
NEWCASTLE-ON-TYNE.
Telegraphic Address: "PARKINSON, NEWCASTLE."

TO GAS AND GENERAL ENGINEERS.

Easy Payment System. Particulars on Application.

JAMES OAKES & CO.
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,
Manufacture and keep in Stock at their Works (also large stock in London)
PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts and Covers, and rendering Leakage impossible.

PREPAYMENT ATTACHMENTS
AND
ALL PARTS FOR GAS & WATER METERS.
Quotations to Samples.
THE
Tourtel Manufacturing Co., Ltd.,
146A, QUEEN VICTORIA STREET, E.C.
Can undertake the Largest Contracts.

HEATHCOTE GAS COAL.
Rich in Illuminating Power and Yield of Gas.
Above the Average in Weight and Quality of Coke.
Maintains a High Standard in Residuals.
THE GRASSMOOR CO., LD.,
CHESTERFIELD.

ESTABLISHED 1873.
Contractors to H.M. Government.

RETORT-SETTINGS
INCLINED, REGENERATIVE, GENERATIVE, AND FLOOR LINE.
SEVERAL THOUSANDS OF OUR SETTINGS IN SUCCESSFUL WORK.

Plans, Estimates, and full Particulars for Complete or Partial Erection and Renewal.

J. & H. ROBUS,
Engineering Contractors for Gas and Water Works,
20, BUCKLERSBURY, LONDON, E.C.,
And GORING, OXFORDSHIRE.

GASHOLDER TANKS. RESERVOIRS.
MAIN LAYING. BORING. WELL SINKING.

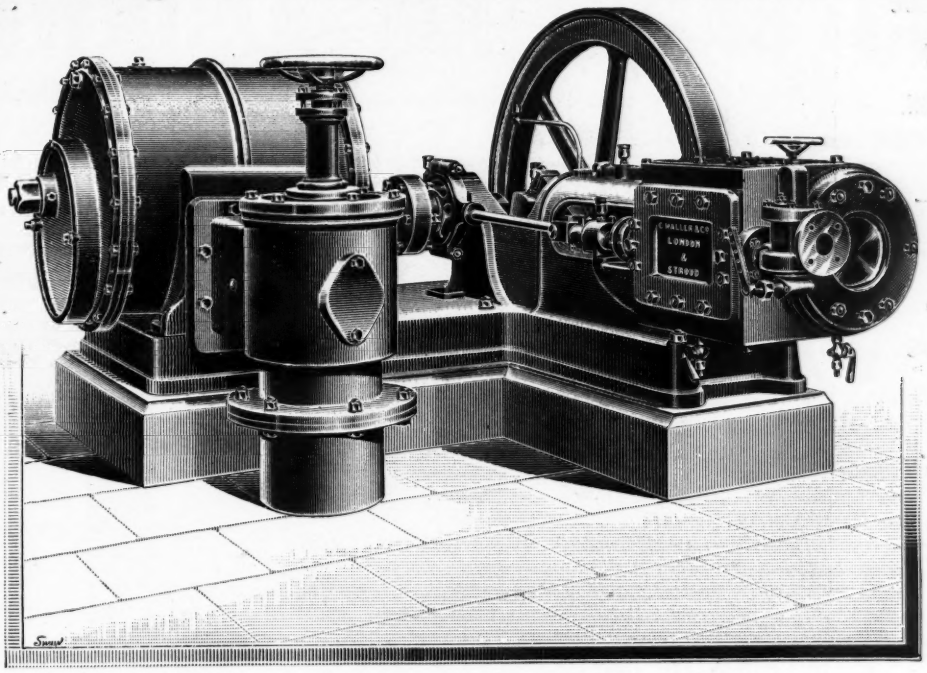
JAMES MILNE & SON, LTD.
Milton House Works EDINBURGH.
LONDON. GLASGOW. LEEDS.

List of STATION METERS
RECENTLY ERECTED AND IN HAND.

GLASGOW	150,000	cubic feet per hour.
DUNDEE	150,000	" "
PAISLEY	150,000	" "
EDINBURGH	125,000	" "
LEEDS	100,000	" "
MIDDLESBROUGH	100,000	" "
WEST HARTLEPOOL ..	100,000	" "
HAMILTON	80,000	" "
KIRKCALDY	80,000	" "
PERTH	80,000	" "
COATBRIDGE	60,000	" "
WOOLWICH	50,000	" "
YEADON	50,000	" "
LINCOLN	45,000	" "
HAWICK	40,000	" "
REDCAR	30,000	" "
INVERNESS	25,000	" "
WISHAW	25,000	" "
BEVERLEY	25,000	" "
HINCKLEY	20,000	" "
WORKINGTON	20,000	" "
ECCLESHILL	15,000	" "

GEO. WALLER & CO.

165, QUEEN VICTORIA STREET, LONDON, E.C.



PATENT EXHAUSTER AND COMBINED ENGINE (30,000 to 80,000 Type). Also made with Slipper Guide.

MANUFACTURERS OF

IMPROVED EXHAUSTING MACHINERY

OF ALL CAPACITIES AND FOR ALL PURPOSES FROM **500** TO **500,000** CUBIC FEET PER HOUR.

WALLERS PATENT 3 & 4 BLADE EXHAUSTERS

Use LESS STEAM and give a STEADIER GAUGE than any other type.

OVER 600 IN USE.

ORDERS RECEIVED LAST YEAR FOR NEARLY **100** SETS.

BEALE'S EXHAUSTERS CONVERTED TO OUR PATENT 3 AND 4 BLADE SYSTEM
to increase their capacity from 30 to 45 per cent. when running at the *same speed*, and giving a *steadier gauge.*

PATENT COMBINED SETS OF EXHAUSTERS AND ENGINE (STEAM OR GAS), FOR 500 TO 15,000 CUBIC FEET PER HOUR WITH DISC VALVES, BYE-PASS GOVERNOR, AND THROTTLE VALVE, ALL ON ONE BASE PLATE.

ALSO MAKERS OF

PATENT PHŒNIX WASHER-SCRUBBERS.

With WOOD CLUSTERS, Simple, Efficient, and Durable.

PATENT STEAM REGULATORS FOR EXHAUSTERS.

Absolutely automatic in their action, and insure level gauge.

GAS VALVES OF ALL DESCRIPTIONS.

PHŒNIX STEAM TAR AND LIQUOR PUMP.

Certain Action, Large Size, Slow Speed.

Coke Breaking, Screening, Elevating, and Conveying Machinery.

WORKS: STROUD, GLOUCESTERSHIRE. Telegrams: London—"WEIGHBEAM LONDON." Stroud—"WALLER BRIMSCOMBE."

WILLEY & CO., ENGINEERS, LONDON & EXETER.

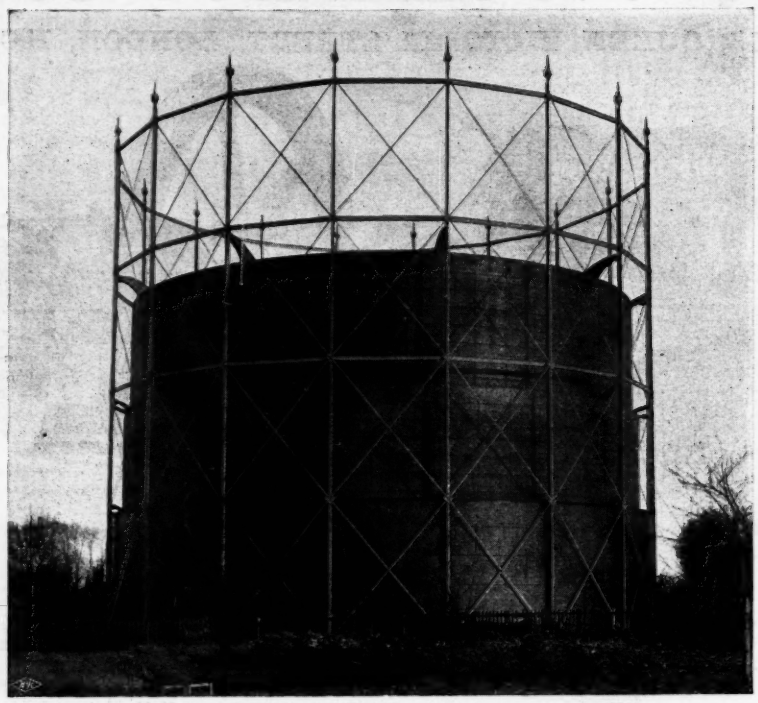
Telegrams: "WILLEY, EXETER." Telephone: 132 and 263.

GAS APPARATUS OF EVERY DESCRIPTION.

ENGINES, EXHAUSTERS AND FITTINGS.

Makers of IMPROVED WOOD GRIDS for PURIFIERS with OAK, CANE, or IRON BOLTS.

TYSOE'S SELF-SEALING MOUTHPIECES.



hree Lift Gasholder and Steel Tank, 90 feet diameter by 14 feet deep, recently erected for the EPSOM GAS COMPANY.

Three-Lift Gasholder, 145 feet diameter by 35 feet deep, in course of construction for the WANDSWORTH & PUTNEY GAS COMPANY.

GASHOLDERS and TANKS.

RETORTS PURIFIERS, CONDENSERS, SCRUBBERS.

GAS-GOVERNORS, STATION METERS CONSUMERS' METERS, PREPAYMENT METERS.

GAS-FITTINGS.

GAS-COOKERS.

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H. KIRKHAM'S
PATENT "IMPERIAL" WASHER-SCRUBBER.

The Dovor Gaslight Company,
Gas-Works, Buckland,
Dover, April 4, 1900.

Re H. KIRKHAM'S PATENT WASHER.

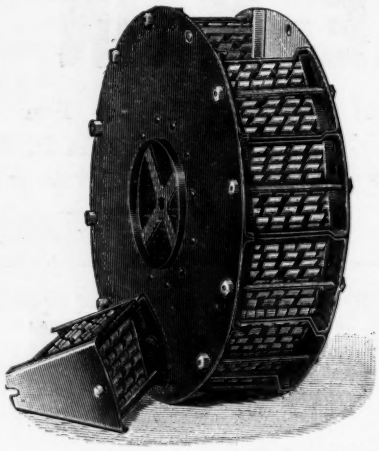
Please note I have much pleasure in stating that one of the above Patent Washers, 1,000,000 cubic feet capacity per 24 hours, has now been in regular action day and night for about 18 months, and is still working to our entire satisfaction.

Six months ago I examined the interior, and then found the Scrolls clean and bright, due, in my opinion, to the flushing action of the fluid rushing from inside the Scrolls.

Also when passing its maximum quantity of gas it gives the minimum of pressure.

For further Particulars see my report to Mr. H. Kirkham, Feb. 8, 1899.

Yours truly,
RAPHAEL HERRING, Engineer.



The Dovor Gaslight Company,
Gas-Works, Buckland,
Dover, Feb. 8, 1899.

H. KIRKHAM, Esq.,

DEAR SIR,—Have now made further tests with the Washer fitted with your PATENT WASHING DEVICES, and have much pleasure in reporting that *the results were highly satisfactory*; also, I ascertained that the maximum results were obtained when the machine was working at three revolutions per minute. At this speed 13 to 14 gallons of water per ton of coal carbonized were converted into 10-oz. Ammoniacal Liquor, and at same time the Gas was free from Ammonia.

Should you wish further details, I will forward them.

I am, dear Sir, yours truly,
RAPHAEL HERRING, Engineer.

The Dovor Gaslight Company, Gas-Works, Buckland,
Dover, Dec. 29, 1900.

H. KIRKHAM, Esq.,
DEAR SIR,—Your Washer fitted with Patent Scroll Devices was put to work Nov. 9, 1898, and has been in regular use to this date. I am sure you will be pleased to know that the excellent results we got when this was first started are still regularly obtained.
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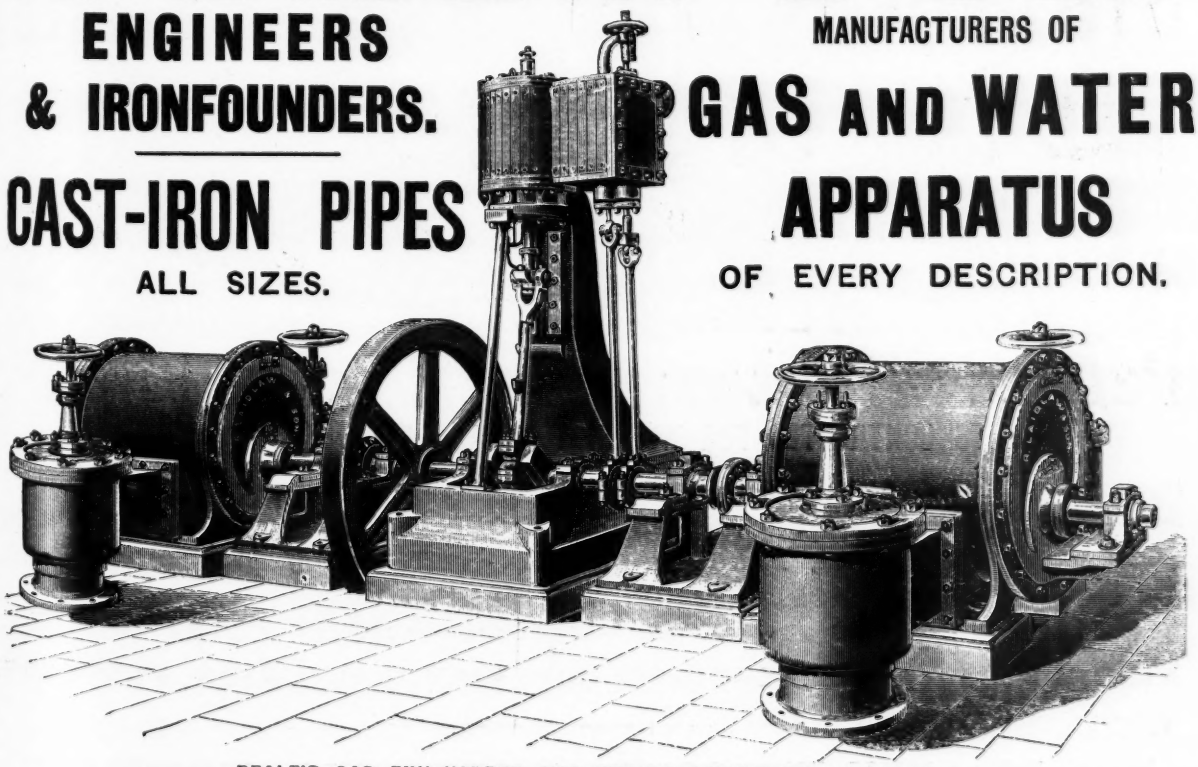

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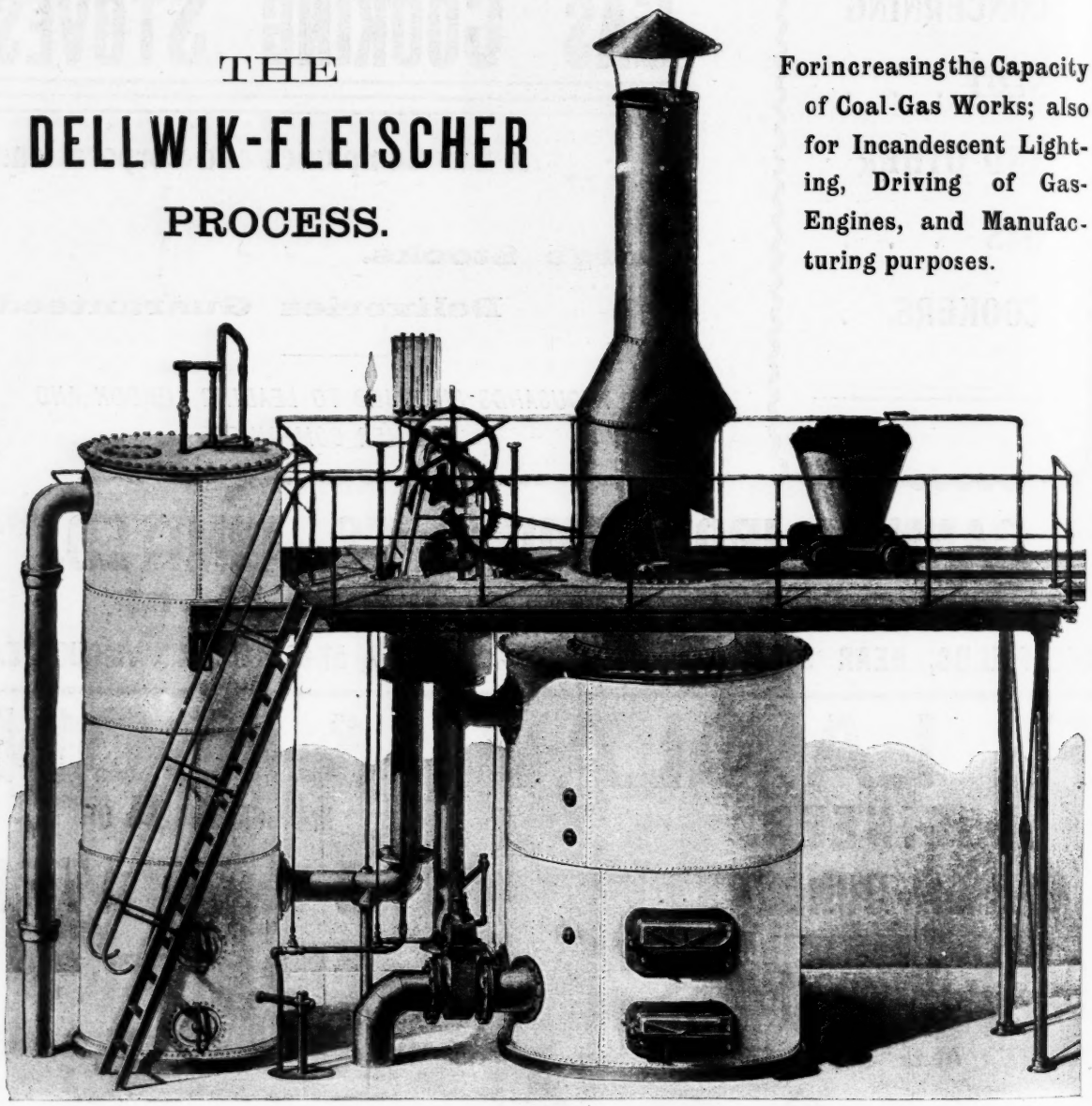

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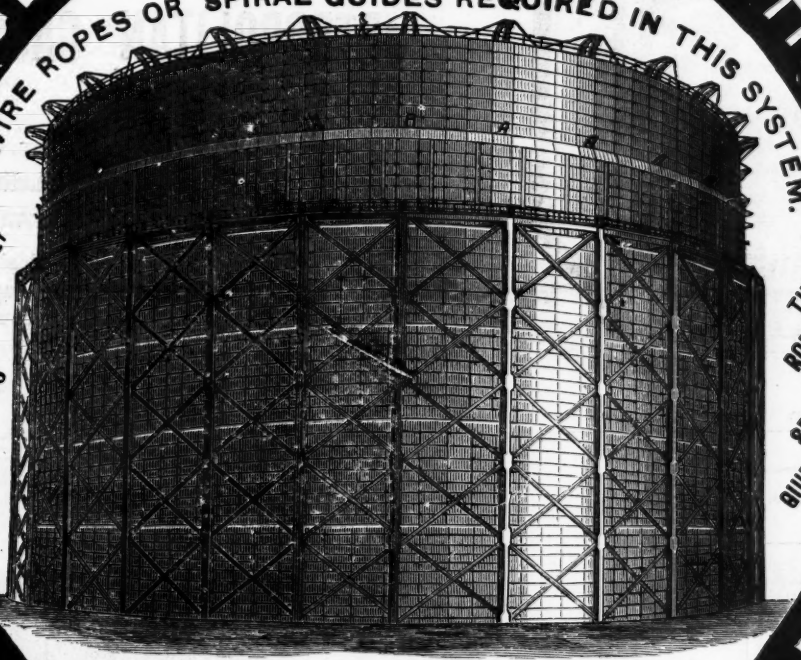

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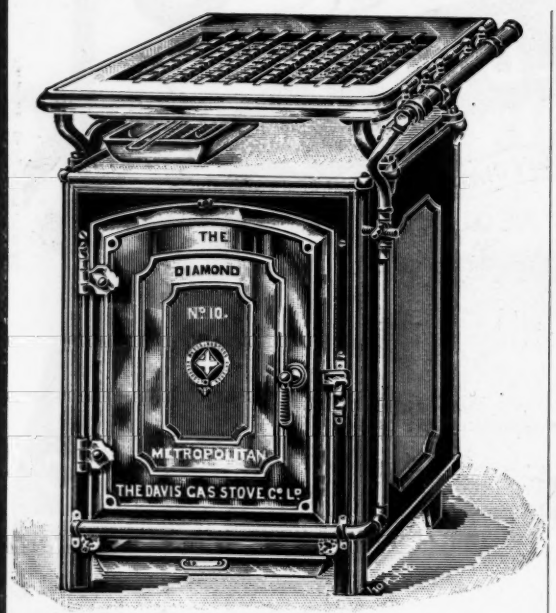

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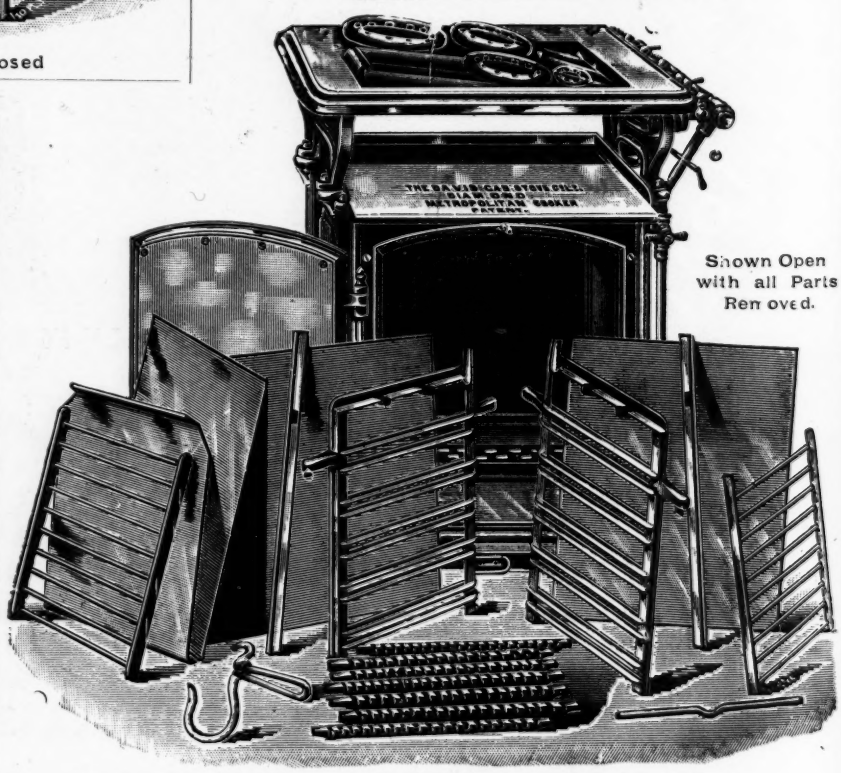
All parts are interchangeable, rendering it an ideal Gas Company's Stove. All parts are easily accessible for cleaning; hence it is an ideal consumers' stove.

No.	Inside Dimensions of Roaster.			Number of Burners on Hot Plate.
	Wide. Inches.	Deep. Inches.	High. Inches.	
7	12	13	22	3
8	12	13	24½	3
9	14	15	26½	4
9a	16	16	28	4
10	17	17	27½	5
10a	18½	17½	28	5
11	20½	20½	29	6

No.	Required Space.			Prices including Deflector for Toasting Apparatus.		
	Wide. Inches.	Deep. Inches.	High. Inches.	£	s.	d.
7	21½	19	31	4	12	6
8	22½	20	33	5	7	6
9	25	22½	35	6	10	0
9a	27	24½	37	7	10	0
10	28½	26	36	8	10	0
10a	30	27	37½	9	10	0
11	34	28	38	12	15	0

Manufactured under Patents Nos. 11,222, 11,223, 11,224, and 11,225, and under License of Patent 13,832.



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A special arrangement is made that, when a change in the price of gas is required, the price can easily be adjusted by the Inspector on the premises; there is no necessity for taking the meter down, and the consumer cannot in any way tamper with this arrangement.

The registered name of the meter is *"Mutual,"* and the patent can be adopted to both wet and dry meters.

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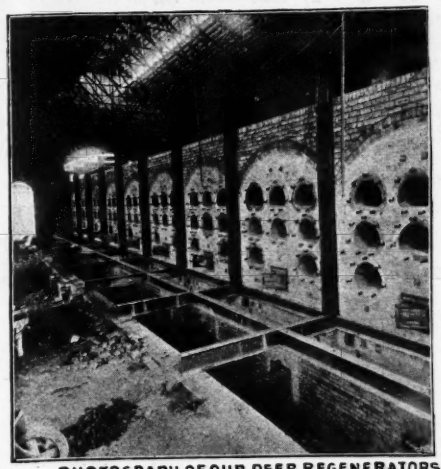

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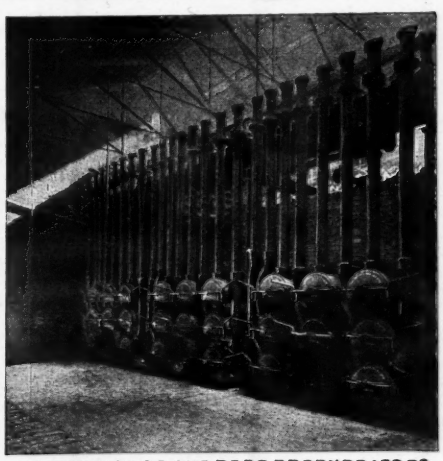

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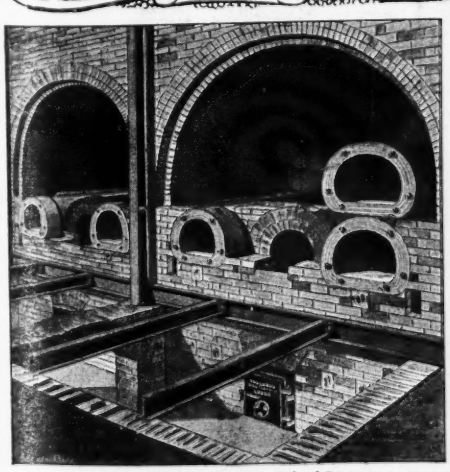

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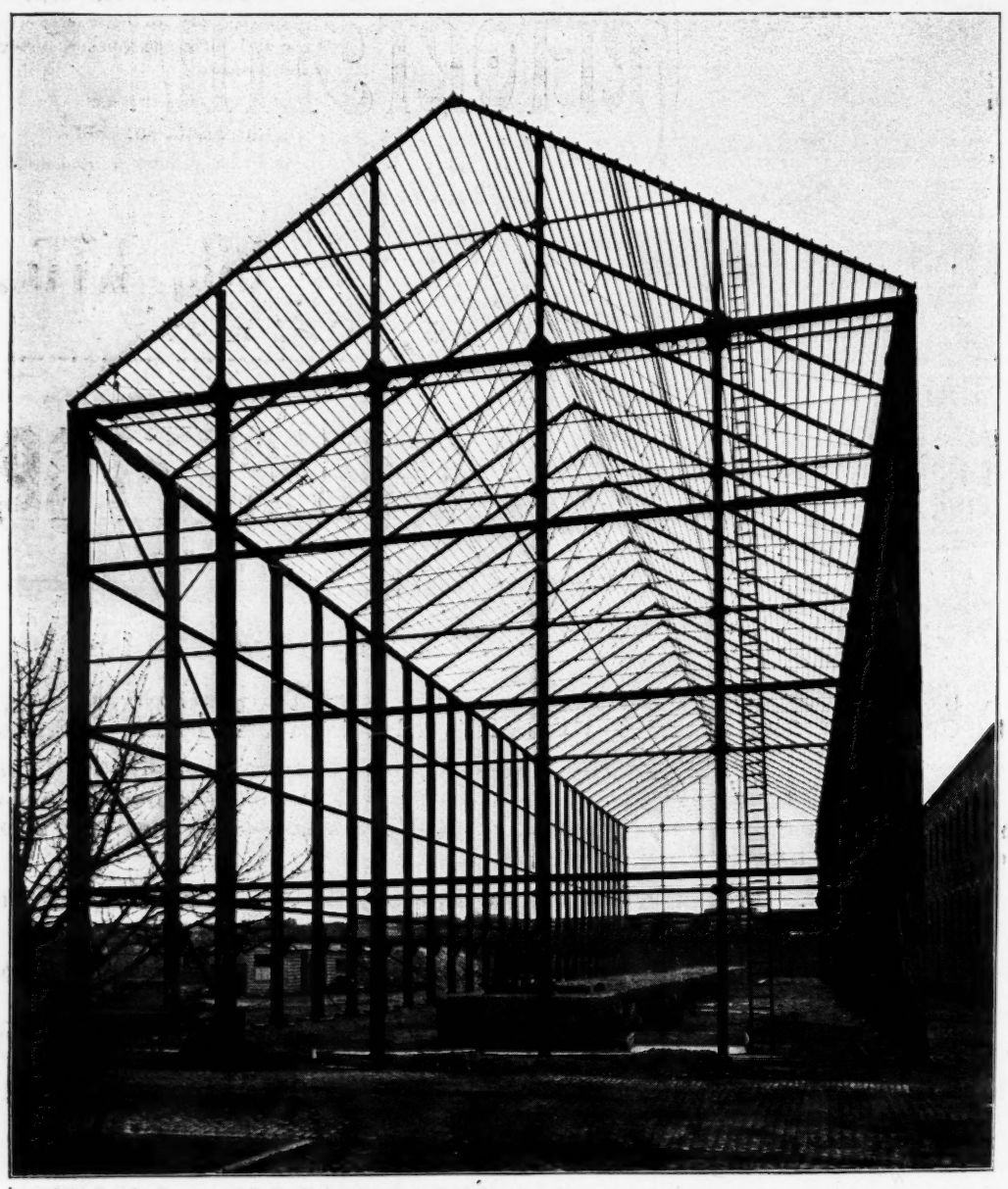

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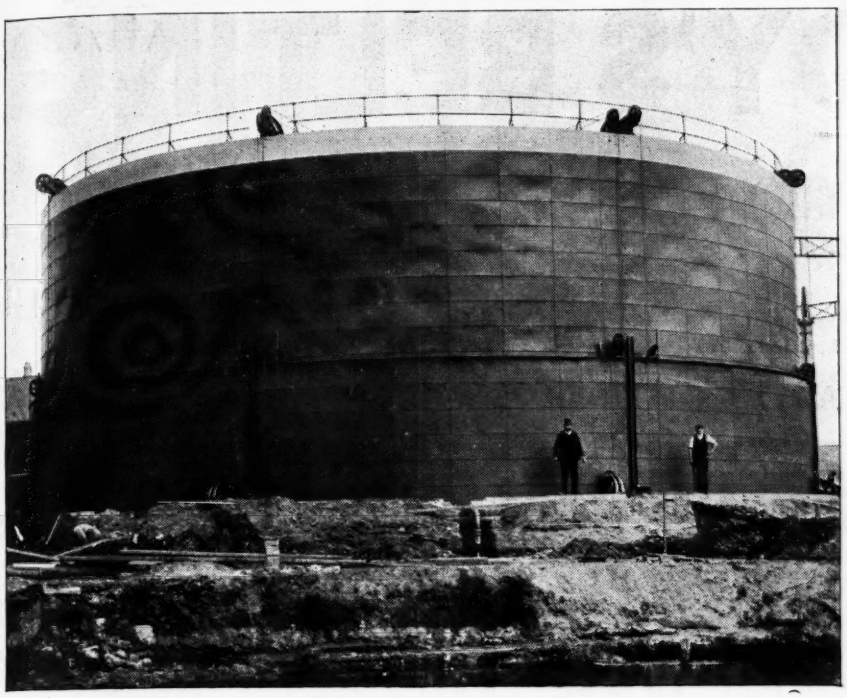

Two-Lift Cable-Guided Gasholder, 80 ft. diameter by 20 ft. deep.
STAFFORD CORPORATION GAS-WORKS. (*From a Photo.*)

COPY OF TESTIMONIAL.

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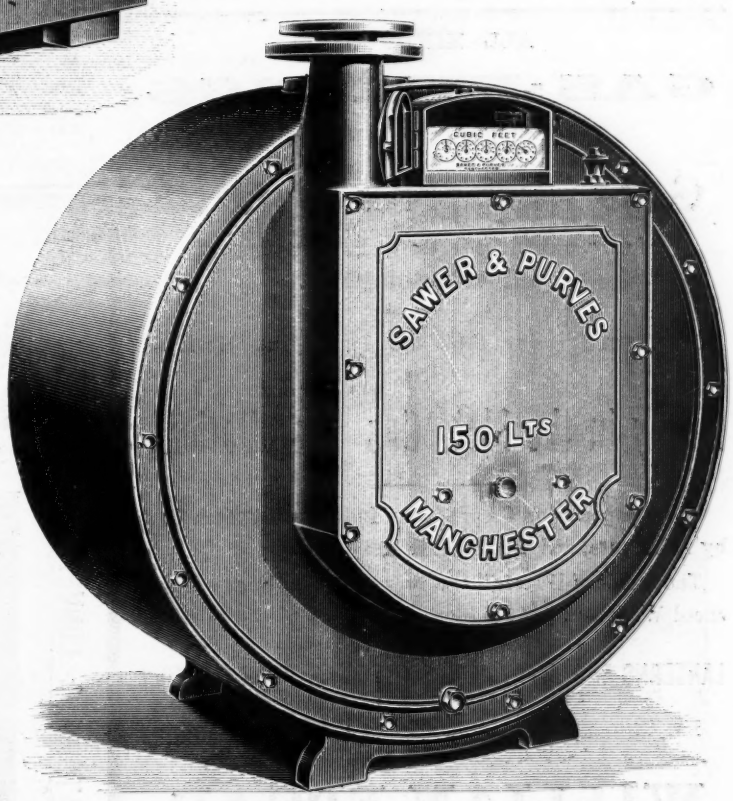

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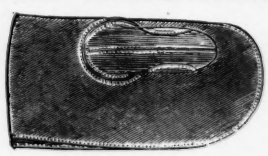

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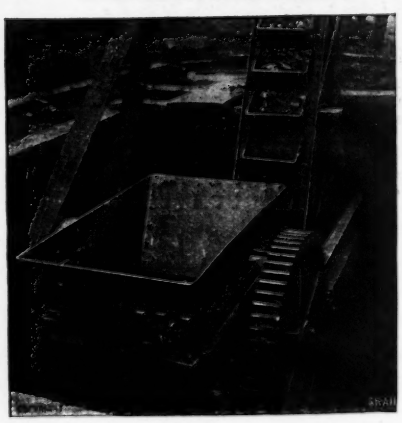

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PHOTO, SHOWING ELEVATOR FOR COLD COKE.

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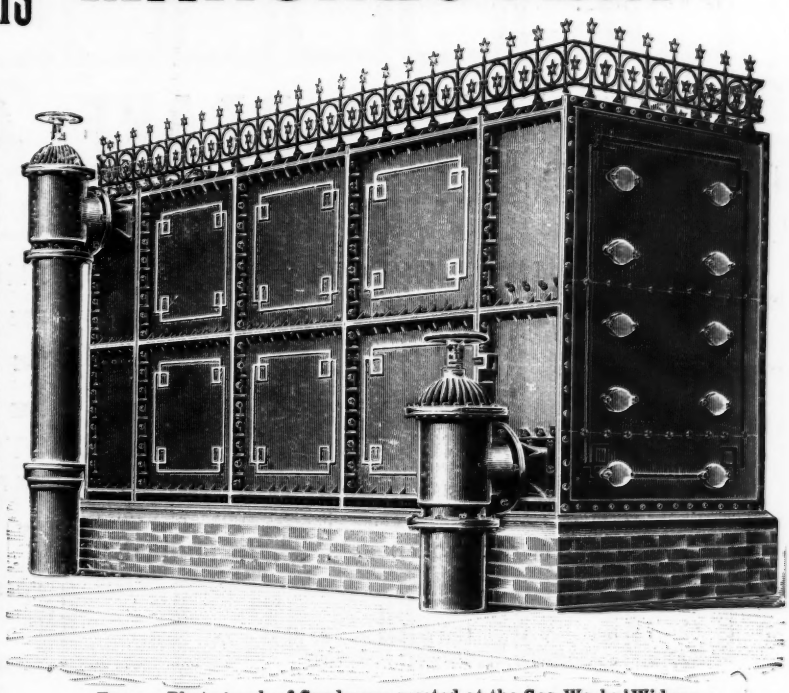
Condensers of this type equal to 10,500,000 cubic feet per 24 hours already erected and at work.



From a Photograph of Condenser erected at the Gas-Works, Widnes.
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